JGS
ENVIRONMENTAL CONSULTANCY

ENVIRONMENTAL IMPACT ASSESSMENT

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Coal Mine in Argyll, QLD

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Environmental Impact Assessment

COAL MINE IN ARGYLL, QLD

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SECTION A:

1.0 INTRODUCTION

This document is an Environmental Impact Assessment (EIA) for a proposed open-cut and underground coal mine in Argyll, Queensland (hereafter referred to as the project). JGS, an environmental consultancy company who specialise and lead in EIAs, are the proponent of the Argyll Coal Mine.

It is estimated that global energy consumption will increase by 53% from 2008 to 2035 (International Energy Association 2011). Australia has the ability to contribute toward the supply of coal until further renewable resources are made viable. It is for this reason that the project is proposed.

This EIA comprises of three sections: Section A describes the proposed project and the associated legislation and triggers; Section B includes methods for impact prediction, criteria for impact analysis, baseline conditions and the impact predictions, and the management and mitigation techniques associated with the impacts; and, Section C includes public involvement, project alternatives and an evaluation to appraise the project impacts and acceptability.

2.0 PROJECT DESCRIPTION

The project site is defined under MLA, Lot 9 CLM355 and covers an area of 14 875 ha (148 754 350m^2). It is located in the Central Highlands Regional Council however it is also expected to impact upon the Isaac Regional Council. The project site is 55km North West of Emerald and 900km North of Brisbane, defined by regional context and local government area boundaries (Figure 1).

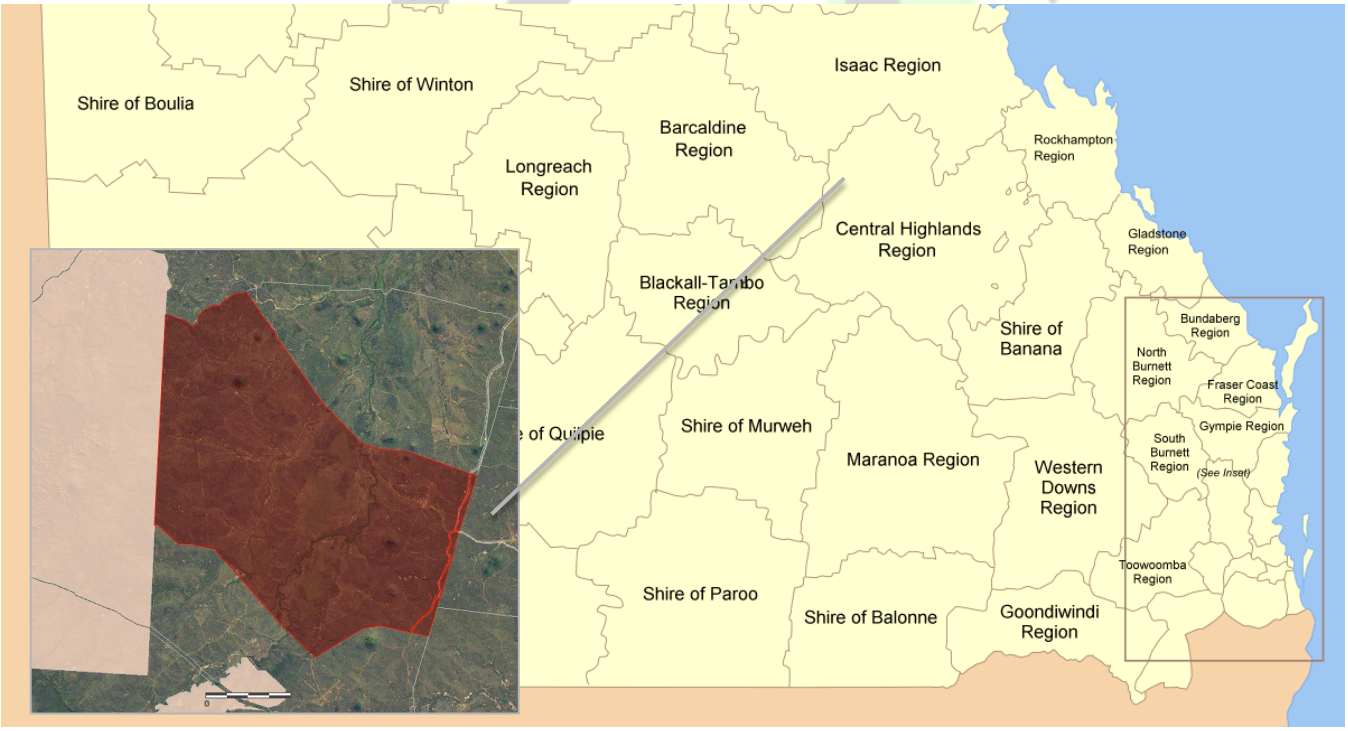

FIGURE 1: MAP SHOWING LOCATION OF PROJECT SITE (SOURCE: QUEENSLAND ATLAS 2012)

The project involves the development and construction of a conventional truck and excavator open-cut coal mine and underground coal mine. The coal mine is set to produce approximately 6 Mtpa of product coal for export. The life cycle is set at 30 years, with the possibility of longer operation. Mining is expected to operate 24 hours a day, 7 days a week, 52 weeks a year. Significant infrastructure and upgrades would be required for the operation and distribution of coal, including:

- Road Upgrades:
  - Reklaw Road
  - Links to the Clermont-Rubyvale Road
- Coal handling and processing plant
- Water supply infrastructure
- Power supply infrastructure
- Run of mine and product coal stockpile
- Waste disposal facilities
- Support infrastructure:
  - Administration buildings
  - Fuel/chemical storing
  - Bathroom facilities
  - Sufficient accommodation
  - Gym/tennis courts
  - Bar/pub/social meeting areas

Prior to on-site development and construction, an initial pre-construction phase will take place to accept tenders and detailed designs for development. The open-cut mining operations will involve strip-mining operations with waste removal by truck-excavator with dozer assistance. Coal will be mined by loaders or excavators into dump trucks and hauled up traditional spoil side ramps to the ROM crushing and handling facility. The final open-cut strip will provide access for the underground operations. The underground mining operations will use underground longwall operations or bord and pillar methods. Coal will be delivered to the surface via conveyor and then transferred to a raw product coal stockpile. The raw product coal will be transported by truck to Emerald where it will be loaded onto trains and transported 280km to the Dalrymple Bay Coal Terminal and shipped to international customers.

It is anticipated that the construction phase and operation phase of the coal mine will consist of 300 and 250 employees respectively. Employees will work according to a fly in fly out (FIFO) basis through Emerald Airport; on-site accommodation will be provided. Employees will be transported to and from Emerald Airport via bus. The proponent has determined that the open-cut and underground ROM coal components will be subject to simple crushing and screening processes and delivered to the market as raw coal product.

3.0 LEGISLATION AND TRIGGERS

To maintain the environmental values and successfully manage the project impacts on air quality, soil and geology, waste, surface water, groundwater, terrestrial and aquatic flora and fauna, social factors and employee health, the relevant legislation and triggers were identified.

The proposed project is set to produce 6 Mtpa of product coal for the first three years of operation, increasing thereafter. It is a requirement under the EP Act (1979) for coal mines producing more than 2 Mtpa of unprocessed coal to warrant an EIA (Department of State Development, Infrastructure and Planning 2013).

It is foreseeable that the project may have significant impacts on the listed threatened ecological communities, listed threatened terrestrial and aquatic flora and fauna species and listed migratory fauna species that occur within the project site. Due to the likely significant impacts on these matters of national environmental significance (MNES), it was determined that the proposed project triggers the need for an EIA under the EPBC Act (1999) (Department of State Development, Infrastructure and Planning 2013).

Furthermore, legislation and regulations relevant to the planning, approval, construction and operation and decommissioning of the proposed coal mine must also be assessed. The identification of approvals, permits, licences and authorities, outlining the head of power and administrative agency, also need to be obtained before commencement of the project. Where relevant, Commonwealth legislation may include but is not limited to the Environment Protection and Biodiversity Conservation Act (1999).

Under national legislation, Commonwealth obligations may include but is not limited to:

- Protection of World Heritage values
- Protection of migratory species
- Commonwealth marine areas
- Listed threatened species and ecological communities
- Protection of National Heritage values
- RAMSAR Wetlands of international importance
- The Great Barrier Reef Marine Park
- Nuclear actions

Under state legislation, Queensland obligations may include but is not limited to:

- Environmental Protection Act (EP) 1994
- State Development and Public Works Organisation Act (SDPWO) 1971

EP Act (1994) is triggered due to the reasons stated above. SDPWO Act (1971) is triggered due to the requirements for the project's major infrastructure to be environmentally responsible.

SECTION B: IMPACT ANALYSIS

4.0 INTRODUCTION

Section B outlines the methods for impact prediction, the criteria for impact analysis then examines the major and minor impacts across eight key areas by detailing the baseline conditions, predicted construction and operation impacts and potential mitigation and management techniques. The eight key areas are: air quality, soil and geology, waste, surface water, groundwater, flora and fauna, social impacts and health of workers. Finally, a summary of all of the proposed monitoring programs is outlined.

5.0 METHODS FOR IMPACT PREDICTION

Various methods and resources were used in a desktop study to predict the likely impacts across all of the eight key areas. Firstly a literature review of the scientific evidence was completed and various research was used to predict impacts. Secondly, the United Nations Environment Programme (UNEP) EIA training manual was consulted to guide the process of impact prediction, assessment and analysis (UNEP 2002). Also, other EIAs and Environmental Impact Statements (EIS) of similar projects were looked at and predictions were scaled to suit the size of this project. The other EIAs and EISs include that of the:

- Arcturus Coal Mine Project (DEHP 2013a),
- Baralaba South Coal project (DEHP 2013b),
- Bundi Coal Project (Metro Coal 2013),
- Dingo West Coal Mine Project (Bandanna Energy 2013),
- Hillalong Coal Project (Rocklands Richfield Limited 2012)
- Byerwen Coal Project (DEEDI 2011),
- Moranbah South Project (Hansen Bailey Environmental Consultants 2012),
- And Clermont Coal Mine Project (Rio Tinto 2005), and
- Xstrata's Newlands Coal Mine (Newlands Coal 2012).

Also, some other resources were used for specific key areas. For example, the ASRIS mapping system was used for soil and geology (CSIRO 2013), the Australian Bureau of Statistics (ABS) was used to obtain statistical data for social impacts and other areas (ABS 2013). Additionally, websites from different state and federal government departments were used as well as the Central Highlands Regional Council (CHRC) and the Isaac Regional Council websites (CHRC 2013; Isaac Regional Council 2013). Finally, options for public involvement, assessment of impacts, evaluation and monitoring were formulated using ideas from other EIAs such as the:

- Tbilisi railway extension (GDC *et al.* 2010),
- Breckenridge Ski Resort (USDA 2011), and
- The Arrow LNG Plant (Coffey Environments 2010).

6.0 CRITERIA FOR IMPACT ANALYSIS

Adapted from the Environmental Impact Statement of the Arrow LNG Plant (Arrow Energy 2012), a criterion for impact analysis was utilized when determining the significance of each impact (Table 1).

The sensitivity of an impact is concerned with the uniqueness, resilience to change and conservational status that an impact may have on the environment (Arrow Energy 2012). The sensitivity is first understood and applied a value rating from very low to high (Table 1). The magnitude of an impact is then considered. The

magnitude refers to the severity and the geological extent of the possible impact (Arrow Energy 2012). The magnitude is understood and then receives a rating from very low to very high (Table 2). Using the ranking from the sensitivity and magnitude criteria, the matrix below (Table 3), is used to establish the significance of the impact. Impacts with a significance mark of Major or Moderate significance require mitigation to prevent the impact from occurring. Impacts of Minor or Negligible significance only require consultation or monitoring.

TABLE 1: SENSITIVITY OF VALUES

SENSITIVITY	DEFINITION
Very High	• An environmental value listed as 'critically endangered' under the IUCN and Commonwealth Government or 'international' under state government. • An environmental value that has international listing or importance. • A topic of incredibly high public concern, that is likely to generate a large response.
High	• An environmental value that is listed as 'critically endangered' under the IUCN, Commonwealth of state governments. • An environmental value that has national importance. • An environmental value of essential (local) commercial or recreational requirement or importance in maintaining ecological integrity (even if not otherwise listed). • A topic of high public concern that is likely to generate public response.
Moderate	• An environmental value that is listed as 'vulnerable' or 'rare' under the IUCN, Commonwealth or state governments. • An environmental value that has state importance. • An environmental value of common or frequent recreational or commercial importance locally. • A topic of public concern that may generate public response
Low	• An environmental value that is listed as 'near threatened' under the IUCN or 'conservation dependent' under the Commonwealth Government or 'least concern' under the state government. • An environmental value that has regional importance. • An environmental value that has occasional recreational or commercial importance locally. • A topic of public interest that may generate a small response.
Very Low	• An environmental value that is common and is not listed under the IUCN, Commonwealth or state governments. • An environmental value with local importance. • An environmental value of no reported recreational or commercial importance locally. • A topic that is unlikely to generate a public response.

Source: Arrow Energy 2012.

TABLE 2: MAGNITUDE OF IMPACTS

MAGNITUDE	DEFINITION
Very High	• Severe, widespread impacts affecting large areas, potentially long lasting and are very likely to happen • Reduce the extent of an ecological community significantly (e.g. 90%) • Destroy habitat crucial for an ecological community's survival • Results in persistent and major adverse changes to an ecological community's life cycle, breeding, feeding or migration • Results in adverse health effects for the wider community
High	• Regional impacts, likely to happen and potentially long lasting. • Reduce the extent of an ecological community by approximately 50%. • Modify the habitat necessary for an ecological community's survival. • Result in major adverse changes to an ecological community's life cycle, breeding, feeding and migration. • Results in adverse health effects for the community.
Moderate	• Localized impacts, likely to happen and which may be long lasting. • Reduce the extent of an ecological community by approximately 25%. • Fragment habitat necessary for an ecological community's survival. • Result in moderate adverse changes to an ecological community's life cycle, breeding, feeding and migration. • Results in health effects for local community (e.g. workers and neighbours).
Low	• Localised impact, likely to happen and which may be short lived. • Reduce the extent of an ecological community by less than 10%. • Disturb habitat necessary for an ecological community's survival. • Result in minor adverse changes to an ecological community's life cycle, breeding, feeding and migration. • May result in in minimal health impacts to some localised individuals.
Very Low	• Impact unlikely to occur. • Extent and population of ecological community stable • Habitat necessary for ecological community's survival is unlikely to be impacted. • The life cycle, breeding, feeding and migration of an ecological community are unlikely to be impacted. • There is unlikely to be any impacts on human health.

Source: Arrow Energy 2012.

TABLE 3: MATRIX OF SIGNIFICANCE

	SENSITIVITY				
MAGNITUDE	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
Very High	**Major**	**Major**	**Major**	**Minor**	**Negligible**
High	**Major**	**Moderate**	**Moderate**	**Minor**	**Negligible**
Medium	**Moderate**	**Moderate**	**Minor**	**Minor**	**Negligible**
Low	**Moderate**	**Minor**	**Minor**	**Minor**	**Negligible**
Very Low	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**

Source: Arrow Energy 2012.

7.0 AIR QUALITY

7.1 Baseline Conditions

The current condition of the air in the Argyll area is considered healthy. This however, may also be partly attributed to the fact that there is little to no monitoring of the air quality in the area. During the pre-construction phase of the project, thorough air quality testing will take place to provide accurate baseline information. The particulates to be tested include but are not limited to: formaldehyde, vinyl chloride, benzene, arsenic and asbestos.

The air quality objectives listed in the Environmental Protection Policy (2008) were used to establish the objectives for the project's dust emissions. In accordance with the Environmental Protection Policy (2008), the objective is to minimize and reduce the amount of pollution that is released into the atmosphere as a direct result of the project's activities.

7.2 Construction and Operation Impacts

As stated above, thorough air quality testing will take place during the pre-construction phase of the project. This is to enable accurate comparisons between the baseline conditions and impacts (if any) on air quality during and after the project's activities. Although mitigation procedures will be effective, it is predicted that dust will be the primary impact on air quality within the project site. While greenhouse gases (GHGs) and other gaseous particulates will be emitted, it is predicted that they will not significantly impact on air quality within the project site as they will be widely dispersed.

Dust

It is predicted that approximately 15 tonnes per annum of dust will be released as a result of the project's activities. As dust particulates (PM10) do not travel far distances, the accumulated dust will be localised within the project site. This impact has moderate sensitivity and high magnitude and is therefore considered to be of moderate significance. It will therefore require detailed mitigation and monitoring strategies, further outlined below.

Emissions

It is predicted that transporting the product coal 24 hours a day, 7 days a week, 52 weeks a year, to and from the project site will account to:

- 1.80g/Km of volatile organic compounds,
- 19g/Km of carbon monoxide,
- 346g/Km of carbon dioxide, and,
- 1.43g/Km of nitrogen oxide and its oxidation states.

The emissions released have moderate sensitivity and high magnitude and is therefore considered to be of moderate significance. It will therefore require detailed mitigation and monitoring strategies, further outlined below.

GHGs and Climate Change

Emitted greenhouse gases will contribute toward widespread air pollution and climate change. This impact will not directly affect the project site or adjacent areas as the pollution will be widely dispersed. The primary contributing pollutants will be carbon dioxide, methane and nitrous oxide. The release of greenhouse gases has moderate sensitivity and high magnitude and is therefore of moderate significance. It will therefore require mitigation, further detailed below.

7.3 Mitigation and Management

It is inevitable that the air quality will depreciate as a direct result of the proposed project. Air quality testing sensors will be introduced throughout the project site to detect and measure the nature and amount of particulates released as a direct result of the project's activities. This will allow for the continual monitoring of the pollutants and their concentration. It is difficult to implement a mitigation strategy for the release of large quantities of greenhouse gases. To compensate for this, carbon offsets will be paid for.

In an attempt to mitigate the release of dust, roads used for product coal transportation will be watered on a daily basis. This will limit the dust particles entering the breathable air.

8.0 SOIL AND GEOLOGY

8.1 Baseline Conditions

The project site is located within the Central Bowen Basin and is characterized by sandstone, mudstone and coal seams and consists of four distinct land zones: 3, 5, 8 and 12 (Table 4) (Brakel *et al.* 2009; DEHP 2012; Wilson & Taylor 2012). The topography is predominantly relatively flat (Table 4). The land primarily consists of alluvial river and creek beds (land zone 3), old loamy and sandy plains (land zone 5), basalt plains and hills (land zone 8), and hills and lowlands on granite rocks (land zone 12) (Table 4) (DEHP 2012; Wilson & Taylor 2012). The soils on the project site are mostly sand with some clay and silt. The average pH of the soil is between 5.6 and 7.0, however soil closer to the waterways can be as basic as 8.5 (CSIRO 2013). The water availability is approximately 15mm in the topsoil and 38mm in the subsoil (CSIRO 2013).

TABLE 4: DESCRIPTION OF LAND ZONES ON SITE

LAND ZONE	3
Description	Recent quaternary alluvial systems
Geology	Consists of closed depressions, paleo-estuarine deposits, which are currently under freshwater influence
Soil	Predominantly vertosols, sodosols, dermosols, kurosols, chromosols, kandosols, tenosols and hydrosols
LAND ZONE	**5**
Description	Tertiary-early Quaternary loamy and sandy plains and plateaus
Geology	Consists of near level and gently undulating plains
Soil	Sandy & loamy soils, tenosols, kandosols, minor deep sandy surfaced sodsols and chromosols
LAND ZONE	**8**
Description	Cainozoic igneous rocks
Geology	Consists of Cainozoic igneous rocks, flood basalts forming extensive plains and low scarps, hills, cones and plugs on trachytes and rhyolites, and associated interbedded sediments, and talus.
Soil	Vertosols, ferrosols and shallow dermosols
LAND ZONE	**12**
Description	Mesozoic to Proterozoic igneous rocks
Geology	Consists of ranges, hills and lowlands, acid intermediate and basic intrusive and volcanic rocks such as granites, granodiorites, gabbros, dolerites, andesites and rhyolites
Soil	Mainly tenosols on steep slopes with chromosols and sodosols on lower slopes

8.2 Construction and Operation Impacts

Soil Erosion

The soils found within the project site consist of sand with some clay and silt (CSIRO 2013). These soil types are typically stable however as they consist of varying sand sizes, there is a high potential for soil erosion. It is predicted that approximately 25 000 tonnes of topsoil will be lost to soil erosion due to the project's activities

Acid Sulphate Soils

The potential to create acid mine drainage (AMD) problems by exacerbating pre-existing acid sulphate soils (ASS) is possible. To test for ASS, titratable sulphidic acidity tests must be performed (Ahern *et al.* 2004). An indication of ASS and thus concern for AMD will be soils pastes with a pH of less than 4.0. As with most land within the Bowen Basin, there are currently problems associated with ASS. It is predicted that the project's activities will increase the amount of disturbance to the project site and thus increase the likelihood that ASS and AMD problems will spread, potentially affecting native ecological communities (Table 2).

Contamination
Approximately 500 000 tonnes of soil will be excavated to construct the open-cut mine and approximately 300 000 tonnes of soil will be excavated to construct the underground mine. The removed soil will be stockpiled and stored onsite to be used for revegetation and redevelopment purposes. It is predicted that soil integrity will suffer a 50% reduction. Construction, operation and decommission activities will contribute approximately 35 000 tonnes of soil to the local waterways and drainage systems. This in turn will increase total suspended solids (TSS) and turbidity.

TABLE 5: COMMON INDICATORS OF ACID SULPHATE SOILS

GEOMORPHOLOGICAL CRITERIA	PRESENT AT PROPOSED SITE
Marine or estuarine sediments	No
Water logged soils	Uncertain
Coastal sand dunes	No
Areas identified containing sulphide minerals and coal deposits	Yes
Acidic groundwater conditions	Yes
Sediments of recent geological age	No

Source: Ahern *et al.* 1998.

The removal of such a significant amount of soil for the construction and continued operation of the project will likely impede surrounding agricultural usage. The development will cause major disruption to the existing soil conditions. Activities such as the excavation, explosive works, vegetation removal and the subsequent stockpiling of the soil will cause both major and significant disturbance and disruption to the surrounding land. In compliance with the Environmental Protection Agency (1994) intervention and mitigation will be required.

8.3 Mitigation and Management

A thorough and concise mitigation strategy for this site will consist of the proposal that no further development on the site be allowed for a period of 30 years after the decommissioning of the mine. This will allow for soils and geology to settle and assist revegetation efforts to succeed. The coal resource will be efficiently extracted. The chosen method of mining, which is an open-cut mine in combination with an underground mine, will be the most effective and efficient at extracting this resource.

The site for the project has a vast array of topsoil and subsurface soils. These soils are suitable for revegetation once the project has been decommissioned. To aid in the management of disturbance to the soils, a Soil Management Plan (SMP) will also be utilized. The types of soils that are most suitable for the revegetation project have been identified and will be stored and stockpiled onsite so they may be used in the Rehabilitation Management Plan (RMP). Also any changes made to the topography during construction and operation of the mine will be rehabilitated to the design established in the rehabilitation management program. As part of the (SMP) soil monitoring stations must be established, using computer modelling to aid in the most effective sites to be selected. Monitoring will also be directed to areas where change is most likely to occur. This will avoid wasting resources on measurement programs and ensure that monitoring provides an early warning system.

To assist in the management of (ASS) a soil engineering team will be utilized, with avoidance being the most preferred method of prevention. Avoidance methods include redesign of earthworks to avoid high sulphide soils and redesign of drainage works to avoid high sulphide soils. (QDMR 2004). To minimise the impact to waterways and groundwater, sheet piling will be used to seal off sediment and using basement tanking to

reduce impact to groundwater. For areas where avoidance cannot be undertaken, three strategies will be employed, firstly the addition of lime or other highly neutralising compounds will be employed, as the soil structure is predominantly sandy, the second strategy will be through hydraulic separation, using mechanical methods such as sluicing or hydro-cycloning. The separated sulphidic material will then need to be neutralised. The third component of the strategy consists of burial of any untreatable sulphidic material (GCCC 2003).

Any erosion issues that arise will be managed by an Erosion and Sediment Control Plan (ESCP), in conjunction with water management procedures, the release of soil into the groundwater and local waterways will be minimal. Data indicates that flora cover of less than 70% will contribute greatly to soil runoff and loss (GCCC 2003). Vegetation cover for most areas directly associated with the mine will be less than 10%, to mitigate the loss of soil and ultimately replace soil loss, the stockpile of 800 000 tonnes will be used for soil rejuvenation (LGAQ 2006). Any vegetation that is cleared will be retained and converted into mulch and placed as a thin layer over the site. Erosion control blankets will also be used, in conjunction with sediment fencing and biodegradable compost filled filler tubes to prevent excessive soil runoff during severe rainfall events.

To manage the sediment contributed to the waterways, flocculant compounds will be used (calcium sulphate). Flocculation compounds can cause an increase in acidity, so monitoring programs will be needed to monitor fluctuations. The use of shaker grids will reduce levels of sediment reaching waterways (GCCC 2003).

In the event that contamination occurs to soil, spill kits will be strategically placed throughout the site, and personnel will have sufficient training in management and use of these kits, any handling and subsequent storage of contaminated wastes will be done in accordance with Australian standards (AS3780:1994, AS1940:2004, AS3833:2007). The proposed management and mitigation plans will ensure that any impacts to the soil and local geology will be minor.

9.0 WASTE

Waste as defined by the Queensland Environmental Protection Act (1994) includes:

- Left over or unwanted by-product from an industrial, commercial, domestic, or other activity; or,
- Surplus to the industrial, commercial, domestic or other activity generating wastes.

Waste at the Argyll Coal Mine will be produced during construction, operation and decommission stages.

9.1 Baseline Conditions

The site as located in the Central Bowen Bases is largely characterised with no evidence of waste.

9.2 Construction and Operation Impacts

TABLE 6: MINE OPERATION WASTE

	DESCRIPTION	CONSTRUCTION	OPERATIONAL	MAJOR IMPACTS
Waste Rock	Overburden material	10 M bcm pa	40 M bcm pa	Acid, water quality
Rejects	Coarse and fine tailings	.02 Mtpa	.08 Mtpa	Acid, water quality

Alkalinity and Salinity of Waste

The alkalinity and salinity of such waste rock can affect the quality of quality of such conditions. The acidity of the waste produced has the ability to produce acidic and alkalinity levels ranging from a pH of 8.7 to 10.2 (Xstrata 2012). This results in a high safety factor with a low level chance of potential acid forming. The

impact of acidity from waste has a moderate sensitivity and a moderate magnitude and therefore is of minor significance and therefore only requires monitoring and continued management to maintain safe levels.

Uptake into Groundwater and Water Stream

Uptake into groundwater, water steam from waste rock and rejects has the ability to affect the quality of water and water environment. The impact of water and ground uptake is of high sensitivity and of moderate magnitude and therefore is of moderate significance and requires the mitigation strategies as stated below.

Spread of Waste

Spread of waste to surrounding locations either through the air or by transport is a possibility which may occur. Movement of coal via trucks to other locations away from the mine may result in the transportation of mine waste to these locations. The above impact is off moderate sensitivity and of high magnitude and is therefore of moderate significance and will require mitigation strategies as shown below.

TABLE 7: GENERAL SITE WASTE

	DESCRIPTION	CONSTRUCTION	OPERATIONAL
General Waste	Kitchenettes, Administration, Living	12tpa	3,000tpa
Recyclable Waste	Kitchenettes, Administration, Living	2tpa	400tpa
Green Waste	Clearing of Vegetation	50,000m2pa	<5tpa
Sewage	Underground and Surface Facilities	25000 kl/pa	45000 kl/pa

Vegetation Clearing

Waste from the clearing of vegetation for the open-cut mine has the ability to affect the biodiversity of the site, and region around the mine, as well as flora and fauna species crucial to the area. This impact is of high sensitivity and of moderate magnitude and therefore of moderate significance and will require mitigation techniques.

Inefficient Waste Disposal

The potential of inefficient disposal of other wastes such as recycling and living waste may be likely to occur. This has potential implications for the mine efficiency and the cumulative impact of an increased work load placed on surrounding council rubbish services and disposal of rubbish.

The inefficient disposal of rubbish is of low sensitivity and is of low magnitude and is therefore of minor significance and will be managed through management plans and continued monitoring.

9.3 Mitigation and Management

Alkalinity and Salinity of Waste

This impact is of minor significance and only requires monitoring and continued management. Regular soil testing will be part of the management plan to ensure soil is of acceptable pH levels throughput the mine life time.

Uptake into Groundwater and Water Stream

This impact is required to address the anticipated effects of uptake of waste rock and rejects into the groundwater water stream. This will be achieved through effective placement and handling of mine waste in

such a way that it will be available for use in the decommission mine stage Waste storage zones have been designated on the mine site to prevent the movement of these wastes into the ground or water cycle.

Spread of Waste

The spread of waste to surrounding locations is of moderate significance and require mitigation. The washing of trucks and trucks tyres carrying coal from the site will occur before and after every trip, this will ensure waste attached to the trucks will not be transported and displaced throughout the region.

Vegetation Clearing

This impact requires the relocation of flora and fauna to adjacent sites with similar characteristics. This will attract species to these locations away from the site.

Inefficient Waste Disposal

General waste and recyclable waste will have colour coded bin and waste stations. This will help prevent the mix of waste into the wrong places. This will increase the efficiency and effectiveness of such systems. This will improve local waste systems as well the overall environmental quality of the region.

10.0 SURFACE WATER

10.1 Baseline Conditions

The site is located within close proximity of wetlands and waterways; the surrounding waterways are primarily sandy creeks and larger, flowing rivers (DEHP 2013a). The site falls within the Nogoa River Catchment, as can be seen in figure 4. Studies recently conducted in the quality of water within the Nogoa River Catchment found that streams where either of a moderate (52% of streams) or poor (42% of streams) condition (Department of Natural Resources and Mines 2013). This was due mostly to the loss of riparian buffering zones caused via clearing of vegetation along creek beds in the area, these zones are and important link to maintaining water quality.

The site is not within close proximity to any RAMSAR internationally important wetlands or DIWA nationally important wetlands. The site does not fall on or near a floodplain; however, some roads in the surrounding area are susceptible to flooding in extreme weather events (CHRC 2011).

10.2 Construction and Operation Impacts

Lowering of Surface Water Levels

Dewatering has the potential to lower groundwater levels; this has a cumulative effect on surface water levels due to groundwater-surface water interactions (National Centre for Groundwater Research 2013). This Impact is considered to be of high sensitivity with a high magnitude as water levels can affect water quality in the entire catchment, this means surface water levels are of moderate significance and as such will require sufficient mitigation, monitoring and management.

Degradation of Riparian Buffering Zones

Also of concern is the loss of riparian buffering zones due to clearing along creek beds, the potential impacts of any clearing of riparian vegetation on-site is magnified due to the concern caused within the catchment area due to this impact. Because of this clearing, riparian zone degradation is considered to be a high sensitivity impact with a very high magnitude, this impact is therefore of major significance and requires the mitigation and monitoring techniques outlined below.

Degradation of Surface Water Quality

Of major concern is the impact of mining activities on water quality, including the impacts outlined above, along with potential point source pollution and pollution associated with mining practices and accidents. Water quality is contributed to via several issues and therefore is deemed to be an impact of very high sensitivity with a very high magnitude. These contribute to make water quality and impact of major significance, requiring the proponent to adhere to the mitigation and monitoring techniques outlined below.

10.3 Mitigation and Management

Lowering of Surface Water Levels

Surface waters levels can be directly affected via the dewatering of groundwater on-site, as such the proponent are committed to monitoring and testing groundwater levels. Groundwater levels tested twice monthly, this will be done via testing bore water wells both on-site and those of private residences within surrounding areas (Environmental Protection Agency 2005). Water concessions will be offered to private bore owners if mining activities are proven to be effecting private bore water levels, if surface water is significantly lowered then the issue will be reported to the relevant authority (DERM) and sufficient action taken to minimize the effects.

Degradation of Riparian Buffer Zones

Studies conducted in the Nogoa River Catchment area stated that poor water quality in the area is caused mostly by excess soil & pollutant run-off due to riparian clearing (Environmental Policy & Planning 2013). As an integral part of this proposal JSG is committed to maintain all riparian buffer zones on-site. Vegetation will be managed as part of the vegetation management program as listed in section (see section 8 above). During decommissioning the proponent has also committed to further rehabilitation of riparian buffer zones, both on site and any area affected via mining processes.

Degradation of Surface Water Quality

As a part of this project the proponent is committed to maintaining, and during decommissioning, improving, water quality within the catchment area and on-site. Due to the nature of this impact all other surface water and groundwater mitigation and monitoring programs must be adhered to in order to successfully achieve these water quality goals.

As part of the proponent's commitment to water quality, a water quality-monitoring program will be constructed to constantly monitor water quality from 5 sites (3 on-site and 2 downstream sites). The monitoring program will focus on 7 key water quality parameters, Nutrients (including total nitrogen, total phosphorous and chlorophyll-a, metals, pH, turbidity, total suspended solids, coliforms and mid-stream depth (as part of surface water levels monitoring). Levels will be required to meet relevant ANZECC water quality guidelines along with any relevant environmental values and water quality objectives outlined in the Nogoa River Environmental Protection Policy (2009). These measurements will be taken monthly and after any significant rainfall events (>20mm/24hours) (Green 2010).

11.0 GROUNDWATER

11.1 Baseline Conditions

There is high potential for groundwater to exist within the gravel and sand deposits of the Quaternary alluvial planes found on and around the site (DEHP 2006). Groundwater movement within the alluvium is likely to be predominantly via inter-granular flow (Brakel *et al.* 2009). Aquifer recharge occurs through surface water (creeks and streams) and floodwater penetrating the strata and infiltration of rainwater (Brakel *et al.* 2009). The Quaternary alluvium is shallow and cannot be considered a substantial aquifer (DEHP 2006). Water availability is approximately 15mm in the topsoil and 38mm in the subsoil. There are 61 groundwater

provinces within Australia as the map in Figure 2 indicates; the proposed mining site is located within the Tasman province, 3F on the map above (Ball *et al.* 2001).

FIGURE 2: MAP OF AUSTRALIAN GROUNDWATER PROVINCES (SOURCE: AUSTRALIAN WATER RESOURCES COUNCIL 2000)

11.2 Construction and Operation Impacts

Due to the nature of the mining project to be undertaken that the potential for groundwater pollution to occur is extensive, mine workings on-site will require dewatering due to the inflow of groundwater from coal seam and from mined long wall panels. Because the site is surrounded by shallow quaternary alluvium, which cannot be considered a substantial aquifer, the potential for groundwater pollution and particularly overall lowering of groundwater levels in the region is significant (ENRR 2010). The EBBC's regulations state that the combined

effects of mining activities across a region may combine and present cumulative effects in a region that may present a significant future risk to natural resource conditions (Moran *et al.* 2010).

This is a particular problem within the mining site; the site sits within the Tasman groundwater province, this province has the highest amount of groundwater use for any groundwater province within Australia (CSIRO 2001). This highlights the importance of a healthy groundwater system within the area. The regulations within the region on groundwater use also state that any mining activity must ensure that private bores within the local groundwater system must not be significantly affected via mine dewatering.

Lowering of Groundwater Levels

The lowering of groundwater levels due to dewatering may affect bore water levels in the region. This is considered to have a high sensitivity, due to the reliance on groundwater within the region and the level of public concern this issue will raise, and a moderate magnitude making this a moderately significant impact and therefore requiring monitoring and mitigation strategies outlined below.

Degradation of Groundwater Quality

Degradation of groundwater quality in the region, this impact has a high level of sensitivity and a high level of magnitude making this impact moderately significant and therefore requiring the mitigation and monitoring techniques outlined below.

11.3 Mitigation and Monitoring

Dewatering is required to remove any toxicant that may enter groundwater systems due to mining activities, this however may have many detrimental effects too groundwater levels. Any water removed from soil aquifers will be placed at a man-made on-site lake, this water will then be treated and re-used for mining purposes, this will lower the demand on naturally occurring surface waters. To ensure the effectiveness of dewatering on water quality within the Nogoa River Catchment monitoring programs have been put in place as detailed above (see section 9 surface water). This monitoring program involves the testing of groundwater levels to ensure dewatering processes do not have a negative effect on groundwater levels.

Due to the nature of the project water related impacts are expected to be felt through both the construction and the operations phases, managing and monitoring of any on-site water issue during these stages will be conducted. As previously stated the proponent is prepared to aid in the reconditioning and improvement of water quality in the area during the decommissioning phase of this project.

12.0 FLORA AND FAUNA

12.1 Baseline Conditions

An EPBC Act Protected Matters Report relevant to the proposed mine site was obtained online via the Australian Government's Department of Sustainability, Environment, Water, Population and Communities (Australian Government 2013). According to this document, within a twenty kilometre radius of the project area there are three listed threatened ecological communities, sixteen listed threatened species, eight listed migratory species and ten listed marine species which are protected under the EPBC Act (Table 1).

TABLE 8: THREATENED ECOLOGICAL COMMUNITIES AND SPECIES.

Table shows Species names, endangerment and vulnerability statuses and likelihood of occurrence in the project area for all listed threatened ecological communities, listed threatened species, listed migratory species and listed marine species protected under the EPBC Act. E= Endangered, V=Vulnerable.

LISTED THREATENED ECOLOGICAL COMMUNITIES		
Name	**Status**	**Likelihood of Occurrence in Area**
Brigalow (*Acacia harpophylla* dominant and co-dominant)	E	Community known to occur
Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin	E	Community likely to occur
Weeping Myall Woodlands	E	Community likely to occur
LISTED THREATENED SPECIES		
Name	**Status**	**Likelihood of Occurrence in Area**
Red Goshawk (*Erythrotriorchis radiatus*)	V	Species or species habitat likely to occur
Squatter Pigeon (*Geophaps scripta*)	V	Species or species habitat likely to occur
Star Finch (*Neochmia ruficauda*)	E	Species or species habitat likely to occur
Black-throated Finch (*Poephila cinta*)	E	Species or species habitat may occur
Australian Painted Snipe (*Rostratula australis*)	E	Species or species habitat likely to occur
Northern Quoll (*Dasyurus hallucatus*)	E	Species or species habitat may occur
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	Species or species habitat may occur
Koala (*Phascolarctos cinereus*).	V	Species or species habitat likely to occur
Collared Delma (*Delma torquate*)	V	Species or species habitat may occur
Ornamental Snake (*Denisonia maculata*)	V	Species or species habitat likely to occur
Yakka Skink (*Egernia rugosa*)	V	Species or species habitat known to occur
Dunmall's Snake (*Furina dunmalli*)	V	Species or species habitat may occur
Allan's Lerista (*Lerista allanae*)	E	Species or species habitat may occur
Fitzroy River Turtle (*Rheodytes leukops*)	V	Species or species habitat may occur
King Blue-grass (*Dichanthium queenslandicum*)	E	Species or species habitat likely to occur
Finger Panic Grass (*Digitaria porrecta*)	E	Species or species habitat likely to occur
LISTED MIGRATORY SPECIES		

Name	Status	Likelihood of Occurrence in Area
Painted Snipe (*Rostratula benghalensis*)	E	Species or species habitat likely to occur
Fork-tailed Swift (*Apus pacificus*)	-	Species or species habitat likely to occur
Great Egret (*Ardea alba*)	-	Species or species habitat known to occur
Cattle Egret (*Ardea ibis*)	-	Species or species habitat likely to occur
Latham's Snipe (*Gallinago hardwickii*)	-	Species or species habitat may occur
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	-	Species or species habitat likely to occur
Rainbow Bee-eater (*Merops ornatus*)	-	Species or species habitat may occur
Satin Flycatcher (*Myiagra cyanoleuca*).	-	Species or species habitat known to occur
LISTED MARINE SPECIES		
Name	**Status**	**Likelihood of Occurrence in Area**
Painted Snipe (*Rostratula benghalensis*)	E	Species or species habitat likely to occur
Magpie Goose (*Anseranas semipalmata*)	-	Species or species habitat may occur
Fork-tailed Swift (*Apus pacificus*)	-	Species or species habitat likely to occur
Great Egret (*Ardea alba*)	-	Species or species habitat known to occur
Cattle Egret (*Ardea ibis*)	-	Species or species habitat likely to occur
Latham's Snipe (*Gallinago hardwickii*)	-	Species or species habitat may occur
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	-	Species or species habitat likely to occur
Rainbow Bee-eater (*Merops ornatus*)	-	Species or species habitat may occur
Satin Flycatcher (*Myiagra cyanoleuca*)	-	Species or species habitat known to occur
Osprey (*Pandion haliaetus*)	-	Species or species habitat likely to occur

Before going ahead with the proposed open-cut coal mine, the Proponent will undertake thorough flora and fauna surveys, paying close attention to the listed threatened species. Habitat modelling for all listed protected species will be undertaken to further refine the probability of these species occurring within or adjacent to the project site.

12.2 Construction and Operation Impacts

Queensland experiences major terrestrial, freshwater and marine and estuarine biodiversity threats. Given the scale and nature of the project, the construction, operation and decommissioning activities are predicted to have adverse effects on native flora and native and/or migratory fauna within the immediate and surrounding areas due to: land clearing, pollution, sedimentation, over-exploitation of water, potential species invasion and habitat degradation and fragmentation.

Potential impacts on flora species include:

- Reduction in available habitat due to loss of land across project site,
- Loss of habitat connectivity across mine infrastructure and pit areas,
- Decrease in distribution of species, and
- Increased introduction and spread of weed seeds via footwear, machinery, vehicles and other mine materials.

Potential impacts on fauna species include:

- Reduction of available foraging and breeding habitat due to loss of land across project site,
- Increased risk of mortality due to vehicle strike and destruction of tree hollows,
- Localised reduction in roost and nesting sites, microhabitats and potential foraging areas,
- Increased habitat fragmentation and loss of connectivity from roadways and other mining infrastructure,
- Displacement of native species from their current home ranges due to noise, vibration and dust associated with construction and operation phases of project,
- Increased introduced species, including cane toad, and
- Mine-related infrastructure, such as sediment dams, may be made accessible (additional water sources).

The construction, operation and decommissioning of the proposed open-cut coal mine will have direct and indirect impacts on native flora and fauna found within and adjacent to the project area, however the Proponent considers it unlikely to significantly impact upon the regional populations due to the broad extent of habitat available in the local region.

In regards to clearing listed threatened ecological communities and listed threatened species, and impacting migratory species, there is a very high sensitivity and very high level of magnitude. This means that the impacts are of major significance and require mitigation and on-going monitoring (refer to Mitigation and Management).

Habitat reduction is considered to have a very high magnitude and very high sensitivity, meaning that it is of major significance. Habitat fragmentation is considered to have a medium magnitude and high sensitivity meaning that it has a moderate significance. The potential for introduced species (both flora and fauna) is considered to have a high magnitude and a high sensitivity meaning that it has an overall moderate significance. Increased mortality of fauna is considered to have a medium magnitude and high sensitivity meaning that it has an overall moderate significance. As each of these impacts have a major or moderate overall significance level they require mitigation and ongoing monitoring.

12.3 Mitigation and Management

JGS has committed to implementing offsets for flora and fauna impacts through the development of Species Management Plans, Weed Management Plans and Pest Management Plans and by undertaking targeted species monitoring programs. Collectively, these approaches will aid JGS in minimising its impacts within and adjacent to the project area.

Much effort will be made to avoid the three listed threatened ecological communities, although it will not be possible in all cases. Along with the *Environment Protection and Biodiversity Conservation Act* 1999, the Proponent complies with the *Vegetation Management Act 1999*, *Nature Conservation Act 1994* and *Nature Conservation Act 1992*. There are several measures in place to minimise the impacts of the project on flora and fauna. Firstly, the Proponent has sought to minimise disturbance on the listed protected flora and fauna species through relocating infrastructure away from areas where they occur and undertaking rehabilitation measures (if required) respectively.

Other mitigation measures in place to minimise potential impacts include but are not limited to:

- A vegetation clearing plan,
- Employing environmental staff to inspect vegetation to be disturbed, prior to clearing and while trenches are open
- Delineate and maintain borders of proposed disturbance areas,
- Hollow logs and hollow bearing trees will be inspected by licenced wildlife spotters, and where possible these logs will be stockpiled for rehabilitation use,
- A rehabilitation plan for disturbed areas which includes installing logs, dead trees and stumps onto the rehabilitated site to provide roosting, feeding and nesting sites for local fauna,
- Personnel will be made aware of wildlife through project induction program,
- Appropriate speed limits for construction and operational vehicles,
- Establish movement corridors for terrestrial fauna species,
- Translocate fauna species, if located, by qualified personnel, and,
- Preparation of feral animal control plan.

13.0 SOCIAL IMPACTS

Social impacts refer to the impacts upon the demographics, the economic conditions, community infrastructure, the health of the community, the culture and heritage of the surrounding area, the social capital of the community, the recreation opportunities and the traditional aboriginal owners of the land.

12.1 Baseline Conditions

The proposed project impacts primarily upon the Central Highlands Region and the Isaac Region in central Queensland. The nearby towns of Clermont and Emerald are also likely to be impacted upon, especially in terms of community infrastructure. A socioeconomic profile of the region provides baseline social conditions and was obtained from several sources including the Australian Bureau of Statistics, the Central Highlands Regional Council and the Isaac Regional Council.

Population

The Central Highlands Region has a population of 29, 544, with 14, 891 males and 13, 642 females (ABS 2011a). The Isaac Region has a population of 23, 212, with 12, 953 males and 10, 259 females (ABS 2011b).

Demographics

Approximately 19.4% of the Central Highland population and 20% of the Isaac population were born overseas, which is lower than the proportion within Queensland - 26.3%. 54.3% of the total population in Queensland aged over 15 have post school qualifications, however 52.7% in CH and 54.9% in Isaac.

Aboriginal Heritage

3.6% of the Central Highlands population are Aboriginal or Torres Strait Islanders, which is the same as the statistics for the rest of Queensland. However, only 2.7% of the Isaac population are (AIATSIS 2013).

Employment and the Local Economy

Queensland unemployment rate is 6.1%, which is much greater than that of the Central Highlands (2.5%) and Isaac (2%) (ABS 2011a; ABS 2011b). 26% of the Central Highlands population and 39.5% of the Isaac population are employed within the mining industry (ABS 2011a; ABS 2011b). The industry that provides the next greatest level of employment is the agriculture, forestry and fishing industry, which employ 11% of the Central Highlands population and 8.6% of the Isaac population (ABS 2011a; ABS 2011b).

Infrastructure

There currently exists major social infrastructure in the nearby towns of Emerald and Clermont, which have hospitals, health facilities, schools, airports and a university (Central Queensland University in Emerald).

Health

The Average life expectancy for males is years 79.5 and females is 84.1 years in Queensland, which is similar to that of Australia (79.7 years for males and 84.2 years for females) (Queensland Government 2012). There also exists a well-established service called the *Central Highlands Community and Primary Health Service*, which helps individuals to get better and takes strain off the hospital systems by providing at-home health care (Central Highlands Primary Care Partnership 2012).

Recreation

The Central Highlands And Isaac Regions have many opportunities for recreation and leisure activities. These include a network of social sports teams, outdoor activities, hiking, fishing, and parks. Parks in the area include Kirks reservoir park, Gong Gong reservoir park and Moorabool reservoir park (CHRC 2013; Isaac Regional Council 2013).

Cultural Heritage and Archaeology

The site does not contain any areas of significant cultural heritage and there are no known archaeologically significant findings on the site (CHRC 2013).

12.2 Construction and Operation Impacts

Aboriginal Heritage

The traditional Aboriginal owners of the land surrounding the Central Highlands Region are the Gayiri (Kairi) group (DATSIMA 2013). There are two places in the wider region that are considered to be important story places and cultural sites (DATSIMA 2013). However, the project is not near these sites and is not expected to have significant impacts on the cultural values of any aboriginal groups. Due to this, this impact is likely to have low sensitivity and low magnitude and therefore has a minor significance rating. Ongoing consultation and communication with aboriginal stakeholders will ensure the impact does not increase in significance.

Changing Demographic and Social Discontent

The influx of workers for the construction of the projects is likely to affect the demographic of the area by changing the social profile. Also, although workers will be accommodated on site once accommodation is built, they will need to be housed in nearby accommodation initially. This will add pressures to existing social infrastructure and increase the traffic on the roads leading to and from the site. Even once onsite accommodation is built and in use, it is likely workers will travel to nearby towns to recreate and utilize the larger facilities such as the hospital and airport, if need be. This influx of workers is likely to create some resistance in some surrounding localities, which are generally quite small and tight-knit. A slight change in demographic and some potential discontent in surrounding communities is an impact with medium sensitivity and low magnitude making it an impact of minor significance and is easily mitigated (see below).

Infrastructure

During both the construction and operation phases there is likely to be an increased demand on the local infrastructure. During the construction phase the workers will be more reliant on the local infrastructure such as medical services. However, the project is set to have many facilities on site that will reduce this demand during the operational phase, such as nurses and recreational facilities. Roads and airports are likely to receive greater use throughout the life cycle of the project as workers fly in and out and coal and construction materials and transported on and off site. This impact is high sensitivity and high magnitude and therefore has a modrate significance. It will be mitigated carefully to reduce this significance to an acceptable level (see below).

Community Health

Mining projects can have potential health effects, which can sometimes spread beyond the project boundaries to the community. These include respiratory illness from the dust and stress and psychological problems from the noise. These impacts have the potential to cause substantial problems for nearby residents and could result in serious resistance from these individuals. This impact has high sensitivity and low magnitude and is therefore of minor significance. Ongoing monitoring through communicating with the nearby residents will ensure the significance of this impact does not increase.

Recreation

The project does not encroach on any land that is currently actively used for recreation and negligible impacts on recreation are predicted.

Increased Employment Opportunities

Both the construction and operation phases of the projects are likely to provide employment opportunities for the local community. Initially there will be requirements for labourers and general workers, some of which will be employed locally. Then the project will require general operation staff such as nurses, kitchen staff, cleaners, et cetera.

Local Economic Boost

The construction phase of this project in particular is likely to provide positive benefits for the local community. There will be an influx of workers and wages into the region and the money will make its way back into the local economy through paying for workers' accommodation, recreational activates, food and other goods and services. Although the operational phase will continue to input money into the local community, accommodation and food will be supplied on site and so outsourced activities are likely to be limited to recreational activities and some shopping.

12.4 Mitigation and Management

Aboriginal Heritage

Although no significant impacts are predicted, ongoing consultation with Aboriginal stakeholders will ensure any potential impacts on aboriginal sites, culture or heritage are recognized and avoided. A cultural liaison officer will be appointed to ensure aboriginal stakeholders and other groups are identified and are consulted with regularly.

Changing Demographic and Social Discontent

To mitigate the potential discontent within the community due to an influx of workers and an altered demographic, community interactive events will be organized. These will include informal social nights, fundraising events, meet and greet evening or other events to build positive social connections between the surrounding communities and the workers. A separate community engagement and liaison officer will be in charge of managing open engagement with community stakeholders. There will be tools in place to allow community members to contest decisions and be heard. Based on community feedback, different community improvement strategies can be employed. For example, community grants and/or improvements to community infrastructure can be offered as compensation for any grievances community groups might express.

Infrastructure

The increased demand on infrastructure will be mitigated by working closely with local and state government agencies and key stakeholders to improve infrastructure that lacks the capacity to support the project. This will include road upgrades on Reklaw Road and other main transport links. It also might require increasing the frequency of flights in and out of Clermont and Emerald airports. The proponent will also work with the CHRC and the Isaac Regonal Council to ensure that an influx of people into the area is not creating too much strain on infrastructure and services. If, in the instance that the pressure is deemed unacceptable by local

governments and stakeholders, the proponent can invest to increase the capacity of infrastructure. To ensure there is no pressures placed on the housing market in the area, all employees will be accommodated on site and will have access to recreational, health, and other facilities on site.

Community Health

A Community Health Monitoring Program will ensure that community health issues are avoided. Nearby residents will be offered a bulk-billed service at the on-site doctor, who will be able to provide general as well as mining-related medical care and advice. This will mitigate potential health concerns and also allow for monitoring of the health of the community. A Noise Monitoring Program will also ensure noise does not impact upon the health of residents and allows potential impacts to be recognised immediately through a complaints registration system (See Section 14.0 Mitigation).

14.0 HEALTH OF WORKERS

14.1 Baseline Conditions

The baseline conditions of workers, considers and understands that to work at the Mine, workers are able to pass a thorough health screening and are considered fit to work. Workers are not to exhibit any health problems which are able to exacerbated by mining activities. These health problems may include physical and mental conditions. The early health screening process will mean the workers are healthy and with a baseline of zero health conditions.

14.2 Construction and Operation Impacts

The impacts of mining activities and mining lifestyle, will impact the health of workers on two health parameters, including physical effects, and mental effects. Academic literature has also been examined to further detail physical and mental impacts and predictions mining can have on workers.

PHYSICAL IMPACTS

Coal Miners' Pneumoconiosis

The inhalation of coal dust from mining activities from direct and indirect adjacency to mining activities can lead to Coal Worker's Pneumoconiosis (Martin 1954). Effects of this illness include respiratory problems and the inflammation of the lungs as well as Fibrosis and Necrosis. The development of respiratory problems has the ability to affect the worker at the time of work as well into the future. This is of moderate sensitivity and of moderate magnitude and is therefore of minor significance and doesn't require a detailed mitigation technique but will still require monitoring and management.

Fatigue

Working long shifts and for long periods of times, lends the opportunity for the fatigue of workers to develop over a period of days and weeks. Fatigue can lead to injury of workers and the workers around them. Fatigue can also lead to mistakes having the potential to decrease capacity and efficiency of mining operations (Springsure Creek 2013a). Minor to major injuries can occur as a result of mistakes arising from fatigue. This is of low sensitivity and of moderate magnitude and is therefore of minor significance and will not require mitigation but will be managed through a monitoring program.

Catastrophic Mine Failure

Catastrophic Mine failure is a possible impact of mining operations; this has the potential to cause serious injury to workers (Adani Mining 2012). The potential of death also arises as a potential impact from the failure of mining operations. Potential structural problems have the ability to cause catastrophic mine failure putting the health of workers and surrounding areas at risk of injury and in the worst case death. This is of high sensitivity and of moderate magnitude and therefore of moderate significance and will require a strategy to mitigation as shown below to lessen the effects of this impact

MENTAL EFFECTS

Depression

Mental health problems can arise from working away from home, in a location which is foreign from their ordinary life. The repetition of mining activities can also lead to potential mental health concerns for workers. Depression can result from such activities and circumstances. Depression can lead to the possibility of self-harm and harm to others, as well as the overall feeling of sadness. Depression can lead to disharmony in the workplace and poor work performance affecting the efficiency of mining operations. Working away from home can also cause family difficulties. These can lead to disharmony in the workplace and also depression. This impact is of low sensitivity and of moderate magnitude and is therefore of low significance and will therefore not require a mitigation strategy, but will be managed through a monitoring program.

14.3 Mitigation and Management

Coal Miners Pneumoconiosis

Masks will be provided for workers to prevent the inhalation of fine mining materials which result from coal mining operations. These masks will prevent respiratory problems from occurring at the time of mining and into the future. Ventilation systems in and around site location where available will be used to improve the quality of air.

Fatigue

Social activities will be provided to improve the quality of life whilst on site. A Gym and recreational areas will be provided for workers to use to give the workers diversity whilst on site, to help improve the morale of workers, and to prevent depression and mental fatigue of mining operations. A bar will also be provided to improve social interaction of workers.

Catastrophic Mine Failure

Catastrophic mine failure resulting in death and injury of workers is of great risk and importance, however the chances of such an event occurring are low. Fundamental and precise mine design will be used to ensure that the chances of such an event occurring will be at the lowest. State of the art technology and mine design will be used to help mitigate this situation from ever arising.

Depression

Onsite support teams will be provided to work with workers to prevent and help with depression and other social problems which could occur. These support teams will be actively throughout the work site and throughout the accommodation and general site to help mitigate the chance and likely hood of depression and other mental effects from occurring.

15.0 MONITORING

15.1 Air Pollution

A Dust Management Plan and an Air Pollution Plan will be used to monitor and asses s particulate matter, dust, volatile chemicals and compounds, as well as the emissions of greenhouse gases, a carbon offset scheme will be in place to help mitigate any greenhouse gases generated during project.

15.2 Soil Pollution

In order to monitor the affects the project has on surface and subsurface soils a combination of monitoring programs will be in place. A Soil Management Plan (SMP) and an Erosion and Sediment Control Plan (ESCP) will be used to manage the effects of erosion and contamination. A thorough Rehabilitation Management Plan (RMP) will be used to manage the stockpile of topsoil excavated from the mine and used in vegetation

restoration. Soil monitoring stations will be established, using computer modeling to aid in the most effective sites to be selected. A soil engineering team will regularly test soil parameters including pH to monitor for signs of increased acid sulphate soils and issues related to acid mine drainage.

15.3 Waste

Storage and disposal of waste in a manner which mitigates the potential degrading impacts is important. Regular workplace compliance audits will take place to ensure that baseline conditions for metals and plastics have been altered as little as possible. As observed in the Newlands Coal Extension Project EIS (Xstrata 2012) audits will take place monthly, and the same approach will be taken in at the Argyll Mine, where Audits will be conducted on a bi-annual basis by an authorised local council representative. Failure to comply with audit requirements and standard conditions will result in penalty units being awarded to the premises. An onsite waste officer will be on hand during construction and operation of the site to ensure the efficient regulation and disposal of waste is conducted in an acceptable and environmentally friendly way, which doesn't impact on the site or surrounding locations.

15.4 Water Pollution

A Water Quality Monitoring Program will be in place, with a suitably qualified environmental officer performing regular monitoring of both the groundwater and surface water. The interval between monitoring will be in accordance with rainfall events, either weekly or monthly. Monitoring stations will be in place at key areas around the site, the monitoring stations will be used to continuously record changes within the water table and local streams. The monitoring program will focus on 7 key water quality parameters, Nutrients (including total nitrogen, total phosphorous and chlorophyll-a), Metals, pH, Turbidity, Total Suspended Solids, Coliforms and Biological Oxygen Demand. Levels will be required to meet relevant ANZECC water quality guidelines along with any relevant environmental values and water quality objectives outlined in the Nogoa River Environmental Protection Policy (2009). If any major changes to the baseline conditions are found, these findings will be reported to the relevant authorities i.e. DERM.

15.5 Flora and Fauna

A Pest Management Plan (PMP) and a Weed Management Plan (WMP) will be in place to control invasive species and a Species Management Plan (SMP) will be enacted to manage the potential relocation of rare and endangered species. A monitoring program to ensure flora and fauna habitat rehabilitation success will be implemented. The project will be enclosed and suitable barriers in place to restrict the migration of species into the site. The barriers will also assist in preventing any degradation in the site boundaries. Suitable native vegetation will also be planted as a buffer around this boundary to minimise any developmental effects from intruding into the surrounding ecosystem.

The monitoring programs will be undertaken as per the same surveying guidelines listed within the coal mine assessment reports found during web-based, desktop searches (Department of Environment and Heritage Protection 2012; Department of Environment and Resource Management 2011). On a fortnightly basis, qualified personnel will undertake thorough surveys to ensure that the management plans are effective. Five site locations, representative of the flora and fauna distribution and abundance of the entire project site, will be chosen to ensure that the mitigation processes were efficient.

15.6 Noise Pollution

In order to manage and monitor noise emissions from the project, 3D computer modelling will be utilized to measure, record and predict noise pollution and its effects on the surrounding community. A toll free hotline will be established for the local community, any complaints or comments that have been put forward by the community will be delivered to the proponent. Any noise emissions, which exceed the standard of 49dB, will be acted upon.

15.7 Archaeological & Cultural Heritage

There will be an appropriate expert that will be employed as an archaeological officer to manage any significant finds that are unearthed during the excavation of ore and construction of mine. A representative from the Heritage Council will conduct monthly inspections of the site during construction and once completed will conduct visits twice yearly in order to monitor and manage any culturally significant finds.

15.8 Community & Employee Health

A Community Health Monitoring Program (CHMP) will be used to monitor project effects on workers and surrounding community, this program will be used to deliver mining related information and ensure workers and the community at large will be able to report on their physical and mental wellbeing. A medical service that is bulk billed to the community will be placed on site, so that any potential health problems can be managed. Onsite doctors will document and issues as they arise, and act upon any associated health problems.

15.9 Health of Workers

As applied in the Carmichael Coal Mine and Rail Project (Adani Mining 2012), systems will be established which will on a daily basis assess the workplace and any potential workplace hazards which may occur. Weekly health forms will need to be filled out by workers, promoting workers reporting their physical and mental wellbeing. These forms will be reviewed by onsite doctors and will be documented so they can act upon any health problems, as well as monitor any cases of health troubles. The prevention of such impacts arising can occur with effective health and support systems in place. On site doctors will be on hand to treat and diagnose any illness or injuries that may occur as a result of mining operations. Workers will be encouraged to report any injuries or health problems that may occur.

15.10 Climate Change

Any increase in the severity and frequency of natural events such as storms and wildfires will be carefully monitored to ensure any affects to climate are minimised and managed accordingly.

SECTION C: OUTCOMES

16.0 INTRODUCTION

Section C provides ideas for public involvement to engage the community in contributing to the project, an overall evaluation of the residual impacts, their severity and their acceptability, proposes project alternatives and concludes this EIA.

17.0 PUBLIC INVOLVEMENT

The proponent will seek to involve all stakeholders in every stage of the planning, construction, operation and decommissioning of the proposed mine. Stakeholders include state government departments, the Central Highlands and Isaac local governments, aboriginal groups, community groups, environmental groups, health providers, local residents and private business owners. A statement of intent was issued to approximately 300 residents, interested individuals, government entities and businesses and was on display at libraries, schools, local government offices, online, community centres, police stations, hospitals, shops, medical centres and in government departments. This was done in the hope of generating public comment and feedback. In addition, bi-monthly community meetings will be held to inform the public, and to engage in meaningful two-way decision-making. The community engagement and liaison officer and the cultural and aboriginal liaison officer will work to ensure that all groups, big and small, are well represented and are able to contribute. The media will be invited to provide coverage of the project, to ensure all community members are aware of the proposal. The two liaison officers will be in charge of preparing a progress report and communicating back to a board of 10 individuals, including the project manager leading environmental officer, who are responsible for discussing community concerns and coming up with ideas to alleviate the concerns and improve the project across the triple bottom line - environmentally, socially and economically.

18.0 ALTERNATIVES

18.1 No Project Alternative

The no project alternative scenario assumes that no development will take place. No environmental damage will occur due to the project and the environment and surrounding areas will remain the same. No waste or pollution will be emitted nor will the harm of flora and fauna species put into jeopardy. The no project alternative will not create over 550 jobs directly related to the project, nor will create any indirect jobs or business opportunities. Any potential and substantial coal royalties which seek to be gained from the project would not be gained by the State.

18.2 Decreased Yield Alternative

One of the primary alternatives that was assessed as a possibility was to mine less coal in the time frame previously suggested (30 years). The original plan of 6 million tonnes in 30 years does not seem to be ecologically or environmentally viable as it stands. This would mean that 200,000 tonnes would be mined per annum. The alternative for this is to mine 3 million tonnes within the 30-year time frame. This would mean that the mine would have an output of 100,000 tonnes per annum. Not only would this decrease the carbon output and cut it by half but it would have a dramatic flow on effect to all other aspects of the mine. Some of these include the use of vehicle transport and the amount of hours they would need to be running each day, the effect on the surrounding environment and its fauna, less need for such large infrastructure and so on. By downgrading the mine, it decreases many of the negative effects previously mentioned and so it is viewed as a viable option that could go ahead.

POSITIVE OUTCOMES:
→ Less employees required for construction and operation of coal mine
As less employees are required, less infrastructural facilities are required. This also leads to less noise pollution and its associated ramifications, less social impacts (both negative and positive).

→ Decreased impacts
Due to the decrease in yield, the significance associated with the impacts involving air quality, soil and geology, waste, surface water, groundwater, terrestrial and aquatic flora and fauna, societal factors and health of the community and workers, will decrease.

18.3 Underground Mine Alternative

Longwall Mining Technique

The Longwall mining technique is an alternative for the project mine site which offers a feasible alternative to open-cut coal mining. This alternative ceases to use the open-cut mining technique and instead incorporates an underground technique which has various positive environment outcomes compared to the open-cut mining technique.

PRODUCTION OUTCOME:
The underground mining technique proposed will scale down the production of coal taken from the mining site, and is likely to produce 4mtpa of coal from the site. This technique will also require a smaller workforce and will decrease the need for the number of trucks and excavators used on the site.

POSITIVE ENVIRONMENTAL RESULTS IN:
→ Less disruption to vegetation
Underground mining will help eliminate the damage down to the top of the earth and vegetation which is on the site. Vegetation clearing will not be necessary for the coverage of the mine. Underground mining will lessen the damage imparted on the flora and fauna located on the site...
The underground mining will not leave an environmental footprint on the surface, resulting in less damage to the scenic amenity of the area (Springsure Creek 2013a).

→ Less particles distributed into the air
The alternative of underground mining will see less particles and pollution released into the air. Dust particles released from open-cut mining, will not be released into the air due to the underground nature of the mining site. The pollution which is normally released into the air will be trapped underground. Air systems will support the workers breathing underground and will not further implicate health problems (Springsure Creek 2013a).

→ Less waste
Due to the scaled down nature of the coal mining, as well as the need to clear vegetation or remove soil or rock above the coal seams, the presence of waste will be decreased through the use of underground mining. Underground mining produces less inter-burden and overburden waste materials (Springsure Creek 2013a).

→ Less noise
The noise produced by an open-cut mine will be decreased if the underground alternative method is used. The majority of noise will be kept below the surface of the earth

UNDERGROUND MINING DISADVANTAGES:
The alternative of underground mining does have its disadvantages.

→ Less safe
Mines of underground nature are vulnerable to the effects of mine collapse and catastrophic mine failure. This puts the lives of workers at greater risk then open-cut mines.

→ More expensive
Underground mines are more expensive and cost more to operate compared to open-cut mines. Underground mines require more complex equipment and support structures compared to open-cut mines. They also take longer to mine and are harder to access coal deposits.

19.0 EVALUATION

This environmental impact assessment has analysed the key impacts across eight major areas: air quality, waste, surface water, groundwater, flora and fauna, social impacts and health of workers. Using defined criteria described in section 4.0 Criteria for Impact Analysis, the significance of each predicted impact was determined. These were found to be of negligible, minor, moderate or major significance. Moderate and major impacts are considered to be unacceptable and require thorough mitigation strategies to reduce the impact. The significance of the likely residual impacts, after mitigation, was also predicted and can be seen in table 9, under 'Residual'. Impacts were deemed to be acceptable only if the impacts could be mitigated and reduced to a negligible or minor significance status. As can be seen in table 9, there are some majorly significant impacts that cannot be mitigated fully and are not considered to be acceptable.

Although the majority of impacts were considered to be acceptable after mitigation, the few that were unacceptable resulted in the need for project alternatives to be investigated. The no project alternative would have no impacts, either negative or positive, but would not be suitable for the needs of the proponent. The decreased yield alternative would decrease the intensity of production and would have lesser impacts in the areas of air quality, groundwater, flora and fauna and social impacts. However, an open-cut mine would still have significant undesirable impacts on 3.4 Vegetation clearing, 4.2 Degradation of riparian buffer zones, 6.1 Habitat reduction and 6.2 Habitat Fragmentation. The underground alternative would be effective in eliminating, or at least minimising these particular impacts, making them more likely to be able to be mitigated.

In order to ensure this project is both economically, socially *and environmentally* viable in the long term, JGS recommends that the proponent consider using a combination of the decreased yield and the underground alternatives. The proponent would be able to extract the same amount of product in the long term, but over a 60-year time period and using underground mining techniques. This would significantly reduce the impacts that come with intense mining, such as noise, fauna mortalities, excessive dust, and groundwater depletion, and would also reduce the impacts associated with clearing the whole site, such as habitat destruction and fragmentation and destruction of riparian buffer zones. The proportion of the site that would be to be cleared would be limited to the entrance of the mine and a smaller (due to less employees needed) administration and accommodation centre at the entrance of the mine.

TABLE 9: SUMMARY AND EVALUATION OF IMPACTS

Response can be: Mon= Monitoring, Con= Consultation, Mit= Mitigation; Significance and residual significance can be: Neg= Negligible, Min= Minor, Mod= Moderate, Maj= Major.

IMPACT	SIGNIFICANCE	RESPONSE	RESIDUAL	ACCEPTABILITY
1.0 AIR QUALITY				
1.1 Dust	Moderate	Mit, Mon	Minor	Acceptable
1.2 Emissions	Moderate	Mit, Mon	Minor	Acceptable
1.3 GHGs and Climate Change	Moderate	Mit	Negligible	Acceptable
2.0 SOIL AND GEOLOGY				
2.1 Soil Erosion	Major	Mon, Con, Mit	Minor	Acceptable
2.2 Acid Sulphate Soils	Major	Mon, Mit	Minor	Acceptable
2.3 Contamination	Minor	Mon	Minor	Acceptable
3.0 WASTE				
3.1 Alkalinity and Salinity of Waste	Minor	Mon	Negligible	Acceptable
3.2 Uptake into Groundwater	Moderate	Mon, Mit	Neg-Min	Acceptable
3.3 Spread of Waste	Moderate	Mit	Neg-Min	Acceptable
3.4 Vegetation Clearing	Moderate	Mit	Mod	Unacceptable
3.5 Inefficient Waste Disposal	Minor	Mit	Neg-Min	Acceptable
4.0 SURFACE WATER				
4.1 Lowering of Surface Water Levels	Moderate	Mon, Mit	Minor	Acceptable
4.2 Degradation of Riparian Buffer Zones	Major	Mon, Mit	Moderate	Unacceptable
4.3 Degradation of Surface Water Quality	Major	Mon, Mit	Moderate	Unacceptable
5.0 GROUNDWATER				
5.1 Lowering of Groundwater Levels	Moderate	Mon, Mit	Minor	Acceptable
5.2 Degradation of Groundwater Quality	Moderate	Mon, Mit	Minor	Acceptable
6.0 FLORA AND FAUNA				
6.1 Habitat Reduction	Major	Mon, Mit	Mod	Unacceptable
6.2 Habitat Fragmentation	Major	Mon, Mit	Mod	Unacceptable
6.3 Introduced Species	Moderate	Mon, Min	Min	Acceptable
6.4 Increased Mortality	Major	Mon, Min	Min	Acceptable
7.0 SOCIAL IMPACTS				
7.1 Aboriginal Heritage	Minor	Con	Neg-Min	Acceptable
7.2 Changing Demographic and Social Discontent	Minor	Mon, Con, Mit	Negligible	Acceptable
7.3 Increased Demand on Infrastructure	Moderate	Mit	Neg-Min	Acceptable
7.4 Impacts on Community Health	Minor	Mon, Con	Negligible	Acceptable
7.5 Recreation	Negligible	Mon		Acceptable
7.6 Increased Employment Opportunities	Positive	Acceptable		Positive
7.7 Local Economic Boost	Positive	Acceptable		Positive
8.0 HEALTH OF WORKERS				
8.1 Coal Miners' Pneumoconiosis		Minor		Acceptable
8.2 Fatigue	Minor	Mon-Mit	Neg-Min	Acceptable
8.3 Catastrophic Mine Failure	Moderate	Mit	Minor	Acceptable
8.4 Depression	Low	Mon	Neg	Acceptable

20.0 CONCLUSION

This Environmental Impact Assessment details the proposed open-cut and underground coal mine in Argyll, Queensland. Section A described the proposed project and the associated legislation and triggers; Section B described methods for impact prediction, criteria for impact analysis, baseline conditions and the impact predictions, and the management and mitigation techniques associated with the impacts; and, Section C described public involvement, project alternatives and an evaluation to appraise the project impacts and acceptability.

It has set forth the primary impacts that the project is predicted to have on the project site and adjacent areas, and provides appropriate monitoring and management policies (where necessary) to ensure the successful implementation of mitigation techniques.

In regards to air quality, the impacts are of moderate significance and require mitigation and monitoring in order to be acceptable. There is one minor and two major impacts in regards to soil and geology, therefore requiring consultation, monitoring and mitigation in order to be acceptable. There are two minor and three moderately significant impacts in regards to waste. While consultation, mitigation and monitoring techniques are implemented, vegetation clearing as an impact remains unacceptable. There is three moderate and two majorly significant impacts in regards to surface water and groundwater. Consultation, mitigation and monitoring practices are in place however, the impacts: degradation of riparian buffer zones, and degradation of surface water quality remain unacceptable. The majority of impacts regarding flora and fauna are of major significance and even after consultation, mitigation and monitoring techniques remain unacceptable. The impacts associated with societal factors and health of community and workers are negligible-minor and only require monitoring. They are deemed acceptable.

A public involvement initiative has been detailed which will seek to involve relevant stakeholders who have vested interests in the operation and outcome of the proposed project. Relevant project alternatives have been provided and have thus been evaluated with the current proposed project. Mitigation techniques were found to be ineffective in fully decreasing the significance of several major impacts.

21.0 REFERENCE LIST

Adani Mining (2012), *Carmichael Coal Mine and Rail Project – Chapter 12 – Hazard and Risk* (online), available: http://www.adanimining.com/Common/Uploads/EISDocuments/81_EISDoc_Hazard %20and%20Risk.pdf (9 October 2013).

Ahern C, McElnea A & Sullivan L (2004) *Acid Sulphate Soils Laboratory Methods Guidelines* (online), available: http://www.nrm.qld.gov.au/land/ass/pdfs/lmg.pdf (10 October 2013).

Ahern CR, Ahern MR & Powell B (1998) *Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils (ASS) in Queensland 1998* (online), available: http://www.nrm.qld.gov.au/land/ass/pdfs/sample_analysis_guide.pdf (10 October 2013).

Arrow Energy (2012) *Arrow LNG Plant – Chapter 19 – Marine and Estuarine Ecology* (online), available: http://www.arrowenergy.com.au/__data/assets/pdf_file/0004/1768/1920-20Marine20and20Estuarine20Ecology.pdf (9 September 2013).

Australian Bureau of Statistics (ABS) (2011a) *National Regional Profile: Central Highlands (R) (Local Government Area)* (online), available: http://www.abs.gov.au/ausstats/abs@nrp.nsf/lookup/LGA32270Main+Features12007-2011 (October 2013).

Australian Bureau of Statistics (ABS) (2011b) *National Regional Profile: Isaac (R) (Local Government Area)* (online), available: http://www.abs.gov.au/ausstats/abs@nrp.nsf/lookup/LGA33980Main+Features12007-2011 (10 October 2013).

Australian Bureau of Statistics (ABS) (2013) *National Regional Profile: Central Highlands (R) (Local Government Area)* (online), available: http://www.abs.gov.au/ausstats/abs@nrp.nsf/Latestproducts/LGA32270Population/People12007-2011?opendocument&tabname=Summary&prodno=LGA32270&issue=2007-2011&num=&view= (10 October 2013).

Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) (2013) *Mura AIATSIS Collections Catalogue* (online), available: http://mura.aiatsis.gov.au/uhtbin/cgisirsi/?ps=bgsBra7lQi/x/27510010/60/1180/X (10 October 2013).

Bandanna Energy (2013) *Dingo West Coal Mine Project* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/documents/dingo-west-ias.pdf (10 October 2013).

Brakel AT, Totterdell JM, Wells AT and Nicolla MG (2009) 'Sequence stratigraphy and fill history of the Bowen Basin, Queensland', *Australian Journal of Earth Sciences: An International Geoscience Journal of the Geological Society of Australia*, vol. 56, no. 3, pp. 401-32.

Bureau of Meteorology (BoM) (2012) 'Emerald', *Climate Data Online* (online), available: http://www.bom.gov.au/climate/data/ (10 August 2013).

Central Highlands Development Corporation Ltd (CHDC) (2012). *Central Highlands Economic Profile* (online), available: http://www.chdc.com.au/wp-content/uploads/2013/03/2012_Central_Highlands_Economic_Profile.pdfhttp://www.chdc.com.au/wp-content/uploads/2013/03/2012_Central_Highlands_Economic_Pr ofile.pdf (10 October 2013).

Central Highlands Primary Care Partnership (2012) *Community Health and Wellbeing* (online), available: http://www.chpcp.org (10 October 2013).

Central Highlands Regional Council (CHRC) (2011), *Central Highlands Strategic Framework – Future Directions for Land Use Planning 2031* (online), Available: http://www.centralhighlands.qld.gov.au/c/document_library/get_file?uuid=c4e97b6e-20fb-4f53-b4ff-11dc9903dd89&groupId=381737 (10 August 2013).

Central Highlands Regional Council (CHRC) (2013) *Our Community* (online), available: http://www.centralhighlands.qld.gov.au/community (10 October 2013).

Coffey Environments (2010) *Environmental Impact Statement Arrow LNG Plant* (online), available: https://bblearn.griffith.edu.au/bbcswebdav/pid-590577-dt-content-rid-1133169_1/courses/3304ENV_3135_GC/ArrowLNGEIAMarineandEstuarineEcology.pdf (10 October 2013).

Department of Aboriginal and Torres Strait Islander and Multicultural Affairs (DATSIMA) (2013) *Aboriginal and Torres Strait Islander Cultural Heritage* (online), available: http://www.datsima.qld.gov.au/atsis/aboriginal-torres-strait-islander-peoples/aboriginal-and-torres-strait-islander-cultural-heritage (10 October 2013).

Department of Employment, Economic Development and Innovation (DEEDI) (2011) *Byerwen Coal Project – Terms of Reference for an Environmental Impact Assessment* (online), Available: <http://www.dsdip.qld.gov.au/resources/project/byerwen-coal/byerwen-coal-tor-for-eis.pdf> (6 August 2013).

Department of Environment and Heritage Protection (DEHP) (2006) *Vegetation Management Act Regional Ecosystem and Remnant Map – Version 6.1: -23.280, 147.550*, The State of Queensland Department of Environment and Heritage Protection, Brisbane.

Department of Environment and Heritage Protection (DEHP) (2012a) *Land Zone Definitions* (online), available: http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/land_zone_definitions.html#download_land_zones_of_queensland (10 August 2013).

Department of Environment and Heritage Protection (DEHP) (2012b) *Queensland Air Monitoring Network* (online), available: http://www.ehp.qld.gov.au/air/monitoring/network/index.html (10 August 2013).

Department of Environment and Heritage Protection (DEHP) (2012c). *Environmental Impact Statement (EIS) Assessment report for the Washpool Coal Mine Project* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/documents/washpool-coal-mine-project-eis-assessment-report.pdf (10 October 2013).

Department of Environment and Heritage Protection (DEHP) (2013a) *Arcturus Coal Mine Project* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/arcturus-coal-mine-project.html#final_terms_of_reference_tor (10 October 2013).

Department of Environment and Heritage Protection (DEHP) (2013b) *Baralaba South Coal project* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/baralaba-south-coal-project.html (10 October 2013).

Department of Environment and Heritage Protection (DEHP) (2013c) *Wildlife Online Extract – Species List for a Specified Point: -23.280, 147.550*, available: http://www.ehp.qld.gov.au/wildlife/wildlife---online/ (20 August 2013).

Department of Environment and Heritage Protection (DEHP) (2013d) 'WetlandMaps – -23.280, 147.550', *WetlandInfo* (online map), available: http://www.ehp. qld.gov.au/wetlandmaps/ (10 August 2013).

Department of Environment and Heritage Protection (DEHP) (2013e) *Environment* (online), available: http://www.ehp.qld.gov.au (10 October 2013).

Department of Environment and Resource Management (DERM) (2011) *EIS Assessment Report for the Codrilla Coal Mine Project* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/documents/codrilla-coal-mine-project-eis-assessment-report.pdf (10 October 2013).

Department of Main Roads (QDMR) & Parsons Brinckerhoff (2004) *Tugun Bypass Environmental Impact Statement* (online), available: http://www.tmr.qld.gov.au/Projects/Name/T/Tugun-Bypass-project/Tugun-Bypass-Environmental-Impact-Statement.aspx (10 October 2013).

Department of State Development, Infrastructure and Planning (DSDIP) (2013) *Infrastructure and Planning* (online), available: http://www.dsdip.qld.gov.au (10 October 2013).

Department of the Environment (2013) *Report by Coordinates* (online), available: http://www.environment.gov.au/webgis-framework/apps/pmst/pmst-coordinate.jsf (10 October 2013).

Environmental Protection Agency (EPA) (2013) *Environment* (online), available: http://www.epa.wa.gov.au (10 October 2013).

GDC Solutions, CENN & APLR (2010) *Tbilisi Railway Bypass Project Environmental and Social Impact Assessment* (online), available: https://bblearn.griffith.edu.au/bbcswebdav/pid-590513-dt-content-rid-1133165_1/courses/3304ENV_3135_GC/Tbililsi%20esia.pdf (10 October 2013).

Gold Coast City Council (GCCC) (2003). *Planning Scheme Policies- Policy 14: Management of Activities located in areas of Acid Sulphate Soils* (online), available: http://www.goldcoast.qld.gov.au/gcplanningscheme_policies/ (10 October 2013).

Hansen Bailey Environmental Consultants (2012) *Moranbah South Project- Initial Advice Statement* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/documents/moranbah-south-project-ias.pdf (5 August 2012).

Isaac Regional Council (2013) *Community* (online), available: http://www.isaac.qld.gov.au/community/home.html (10 October 2013).

Local Government Association of Queensland (LGAQ) (2006) *Introductory Erosion and Sediment Control Guidelines for Queensland Councils* (online), available: http://nrmonline.nrm.gov.au/catalog/mql:2770 (10 October 2013).

Martin JE (1954), 'Coal miners' pneumoconiosis', *American Journal of Public Health and the Nation's Health*, 44(5):581-91.

McKenzie N, Henderson B & McDonald W (2002) *Monitoring Soil Change – Principles and Practices for Australian Conditions* (online), available: http://www.clw.csiro.au/publications/technical2002/tr18-02.pdf (10 October 2013).

Metro Coal (2013) *Bundi Coal Project Initial Advice Statement* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/documents/bundi-coal-ias.pdf (10 October 2013).

Newlands Coal (2012) *Xstrata's Newlands Coal Mine EIA* (online), available: http://www.xstratacoal.com/EN/Operations/EISVolume1/02%20Executive%20summary.pdf (10 October 2013).

Rio Tinto (2005) *Clermont Coal Mine Project Environmental Impact Statement- Supplementary Report* (online), available: http://www.dsdip.qld.gov.au/resources/project/clermont-coal-mine/ccm-supplementary-eis.pdf (29 July 2013).

Rocklands Richfield Limited (2012) *Hillalong Project- Initial Advice Statement* (online), available: http://www.ehp.qld.gov.au/management/impact-assessment/eis- processes/documents/hillalong-ias.pdf (6 August 2013).

Springsure Creek (2013), *Springsure Creek Coal Mine Project Environmental Impact Statement – Chapter 15- Health and Safety* (online), available: http://www.springsurecreekproject.com.au/assets/library/Springsure_Creek_Coal_EIS/Revised_EIS_Chapters/15_Health_and_Safety.pdf (17 September 2013)

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2013) 'ASRIS Maps – -23.280, 147.550', *ASRIS (Australian Soil Resource Information System)* (online map), available: http://www.asris.csiro.au/# (10 August 2013).

The State of Queensland (1986) *Soil Conservation Act 1986* (online), available: https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/S/SoilConservA86.pdf (10 October 2013).

The State of Queensland (1994), *Queensland Environmental Protection Act 1994* (online), available: https://www.legislation.qld.gov.au/LEGISLTN/ACTS/1994/94AC062.pdf (3 October 2013).

The State of Queensland (2012) *Life expectancy at birth (years) by sex, Queensland and Australia, 1881 to 2011* (online), available: http://www.oesr.qld.gov.au/products/tables/life-expectancy-birth-years-sex-qld/index.php (10 October 2013).

The United States Department of Agriculture (USDA) (2011) *Peak 6 Project- Draft Environmental Impact Statement* (online), available: https://bblearn.griffith.edu.au/bbcswebdav/pid-590517-dt-content-rid-1133168_1/courses/3304ENV_3135_GC/Ski%20resort%20draft%20EIS.pdf (10 October 2013).

United Nations Environment Programme (UNEP) (2002) *EIA Training Resource Manual 2nd Edition* (online), available: https://bblearn.griffith.edu.au/bbcswebdav/pid-590579-dt-content-rid-1133170_1/courses/3304ENV_3135_GC/EIA_E_top6EIA%20impact%20with%20evaluation.PDF (10 October 2013).

Wilson PR & Taylor PM (2012) *Land Zones of Queensland* (online), available: http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/pdf/land_zones_of_queensland.pdf (10 October 2013).

Xstrata (2012) *Newlands Coal Extension Project EIS – Chapter 8 – Waste* (online), available: http://www.xstratacoal.com/EN/Operations/EISVolume1/Chapter%208%20-%20Waste.pdf (25 September 2013).