ATLAS-CAMPASPE
Mineral Sands Project
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX N 〉 PRELIMINARY HAZARD ANALYSIS

CRISTAL Resource Strategies

ATLAS-CAMPASPE MINERAL SANDS PROJECT

PRELIMINARY HAZARD ANALYSIS

OCTOBER 2012
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1 INTRODUCTION

The Atlas-Campaspe Mineral Sands Project (the Project) includes the development of a mineral sands mining operation (herein referred to as the Atlas-Campaspe Mine) located approximately 80 kilometres (km) north of Balranald, New South Wales (NSW) and 270 km south-east of Broken Hill, NSW (Figure 1). The Project is also proposed to involve the construction and operation of a rail loadout facility located near the township of Ivanhoe (the Ivanhoe Rail Facility) approximately 135 km north-east of the Project site and approximately 290 km east-southeast of Broken Hill, NSW (Figure 1).

Product (Mineral Concentrate) generated as a result of operations at the proposed Atlas-Campaspe Mine would be trucked to the Ivanhoe Rail Facility for transfer to rail carriages, which would then be railed to the existing Broken Hill Mineral Separation Plant (the MSP) (Figure 1).

This Preliminary Hazard Analysis (PHA) has been conducted as part of the Environmental Impact Statement (EIS) to evaluate the potential hazards associated with the Project in accordance with the general principles of risk evaluation and assessment outlined in the NSW Department of Planning and Infrastructure (DP&I) *Multi-Level Risk Assessment* (NSW Department of Planning [DoP], 2011a). This PHA also addresses the requirements of *State Environmental Planning Policy No. 33 - Hazardous and Offensive Development* (SEPP 33) and has been assessed in general accordance with *Hazardous Industry Planning Advisory Paper (HIPAP) No. 6: Hazard Analysis* (DoP, 2011b).

Assessed risks are compared to the qualitative risk assessment criteria developed in accordance with Australian Standard/New Zealand Standard (AS/NZS) International Organization for Standardization (ISO) 31000:2009 *Risk Management – Principles and Guidelines* (AS/NZS ISO 31000:2009). Further, this PHA considers the qualitative principles provided in *HIPAP No. 4: Risk Criteria for Land Use Safety Planning* (DoP, 2011c) and guidance provided on the purpose of a PHA in *Applying SEPP 33 (Consultation Draft)* (DoP, 2008).

1.1 OBJECTIVE AND SCOPE

The objective of this PHA is to identify the off-site risks posed by the Project to people, their property and the environment and assess the identified risks using applicable qualitative criteria. In accordance with *Multi-level Risk Assessment* (DoP, 2011a), this assessment specifically covers risks from fixed installations and does not encompass transportation by pipeline, road, rail or sea.

This PHA therefore considers off-site risks to people, property and the environment (in the presence of controls) arising from atypical and abnormal hazardous events and conditions (i.e. equipment failure, operator error and external events). This assessment does not consider risks to Cristal Mining Australia Limited (Cristal Mining) employees or property, or risks that are not atypical or abnormal (e.g. long-term effects of typical dust emissions). For the purposes of this PHA the site is defined as the Development Application area for the Project (Attachment 2 of the EIS).

On-site environmental risks and potential long-term off-site impacts are considered in the Environmental Risk Assessment (Appendix O of the EIS) and, where relevant, the following studies conducted for the EIS:

- Flora Assessment (Appendix A of the EIS).
- Fauna Assessment (Appendix B of the EIS).
- EPBC Act Controlling Provisions (Appendix C of the EIS).
- Road Transport Assessment (Appendix D of the EIS).
- Aboriginal and Non-Aboriginal Cultural Heritage Assessment (Appendix E of the EIS).
- Hydrogeological and Water Supply Assessment (Appendix F of the EIS).

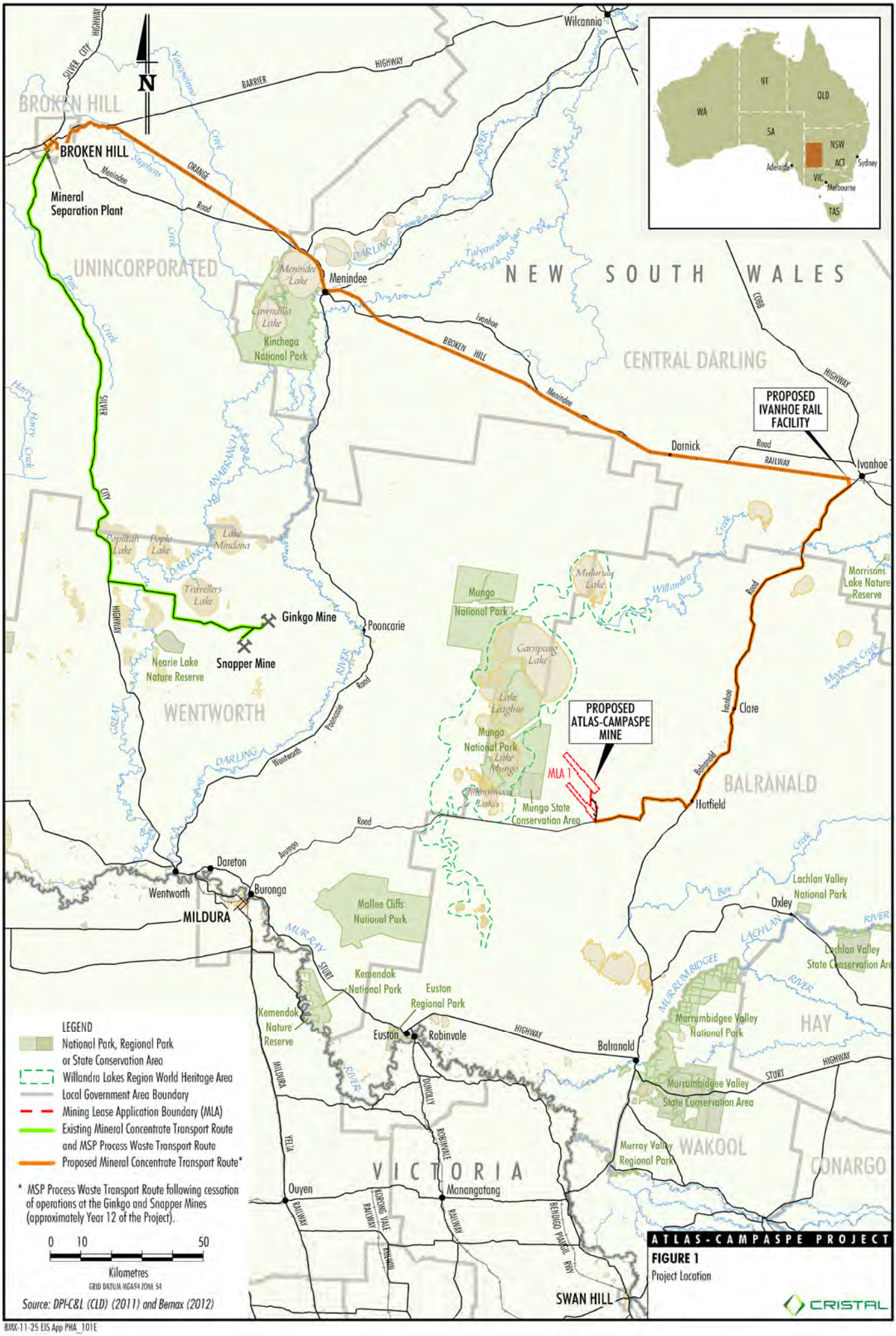

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FIGURE 1

Project Location

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- Surface Water Assessment (Appendix G of the EIS).
- Soils, Rehabilitation Capability and Agricultural Resources Assessment (Appendix HA of the EIS).
- Socio-Economic Assessment (Appendix I of the EIS).
- Noise Assessment (Appendix J of the EIS).
- Air Quality and Greenhouse Gas Assessment (Appendix K of the EIS).
- Mineral Concentrate and Process Waste Materials Assessment (Appendix L of the EIS).
- Land Contamination Assessment (Appendix M of the EIS).

1.2 PRELIMINARY SCREENING PROCESS

Preliminary screening to determine the requirement for a PHA was undertaken for the Project, taking into account broad estimates of the possible off-site effects or consequences from hazardous materials present on-site and their locations. Potentially hazardous industry is defined in the *Multi-Level `Risk Assessment* (DoP, 2011a) as having *potential for significant injury, fatality, property damage or harm to the environment in the absence of controls*.

Accordingly, it was determined that the Project is potentially hazardous as the team could not discount the possibility of harm to the off-site environment in the absence of controls.

According to *Multi-Level Risk Assessment* (DoP, 2011a), a Level 1 assessment can be justified if the analysis of the facility demonstrates that there are no major off-site risks, if the technical and management controls are well understood and where there are no sensitive surrounding land uses.

The PHA review team (Section 1.3.1) reviewed this screening process and concluded that there is limited potential for scenarios with significant off-site consequences as the only sensitive land use in the area surrounding the Atlas-Campaspe Mine Site is the Mungo National Park (approximately 5 km away), the Mungo State Conservation Area (approximately 8 km away) and the Willandra Lakes Region World Heritage Area (approximately 10 km away). With respect to the Ivanhoe Rail Facility, the closest sensitive land use in the surrounding area is the Kajuligah Nature Reserve, approximately 40 km to the north-east. Accordingly, the team implemented a Level 1 assessment (Qualitative analysis) for this PHA.

1.3 STUDY METHODOLOGY

The methodology employed during the preparation of this PHA was as follows:

(i) Identify the hazards associated with the Project.

(ii) Analyse the consequence of identified hazardous events.

(iii) Qualitatively estimate the likelihood of hazardous events.

(iv) Propose risk treatment measures.

(v) Qualitatively assess risks to the environment, members of the public and their property arising from atypical and abnormal events and compare these to the risk criteria outlined in *HIPAP No. 4: Risk Criteria for Land Use Safety Planning* (DoP, 2011c).

(vi) Recommend further risk treatment measures, if necessary.

(vii) Qualitatively determine the residual risk assuming the implementation of the risk treatment measures.

1.3.1 Preliminary Hazard Analysis Review Team

The above methodology was implemented during a PHA multi-disciplinary team based risk review on 18 July 2012. The review participants included technical advisors from Cristal Mining and personnel from Resource Strategies including:

Cristal Mining

- Geology and Exploration Manager – Ray Roberts.
- Senior Environmental Advisor – Michael Priest.
- Senior Geologist – Tara Smith.

Resource Strategies

- Principal – Peter Cribb.
- Senior Environmental Manager – Lucas Burns.
- Senior Ecologist – Environmental Manager – Jamie Gleeson.
- Environmental Manager – Joe Hickey.

1.3.2 Risk Management Process

This PHA has been undertaken with regard to the risk management process described in AS/NZS ISO 31000:2009. The risk management process is shown schematically on Figure 2 and includes the following components:

- Establish the context – Sections 1 and 2.
- Identify risks – Section 3.2 and Attachment A.
- Analyse risks – Section 4 and Attachment A.
- Evaluate risks – Section 4 and Attachment A.
- Treat risks – Section 3.2.3 and Attachment A.

1.3.3 Risk Criteria

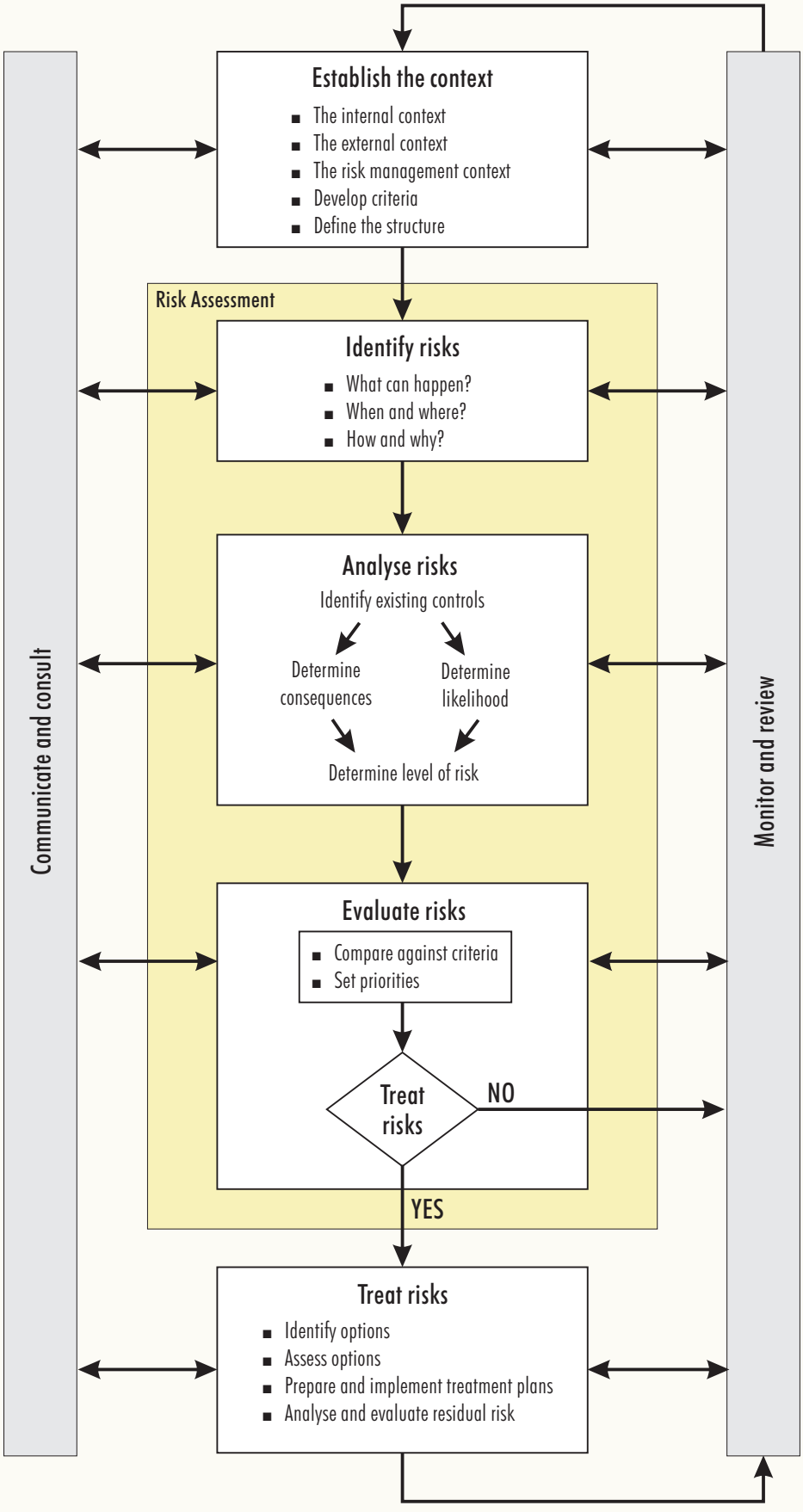
This PHA considered the following qualitative principles (DoP, 2011c):

(a) *All 'avoidable' risks should be avoided. This necessitates investigation of alternative locations and technologies, wherever applicable, to ensure that risks are not introduced in an area where feasible alternatives are possible and justified.*

(b) *The risks from a major hazard should be reduced wherever practicable, irrespective of the value of the cumulative risk level from the whole installation. In all cases, if the consequences (effects) of an identified hazardous incident are significant to people and the environment, then all feasible measures (including alternative locations) should be adopted so that the likelihood of such an incident occurring is made very low. This necessitates the identification of all contributors to the resultant risk and the consequences of each potentially hazardous incident. The assessment process should address the adequacy and relevance of safeguards (both technical and locational) as they relate to each risk contributor.*

(c) *The consequences (effects) of the more likely hazardous events (i.e. those of high probability of occurrence) should, wherever possible, be contained within the boundaries of the installation.*

(d) *Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.*



Source: AS/NZS ISO 31000:2009 Risk Management - Principles and Guidelines

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FIGURE 2

Risk Management Process

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1.3.4 Qualitative Measures of Consequence, Likelihood and Risk

To undertake a qualitative risk assessment it is useful to define (in a descriptive sense) the various levels of consequence of a particular event, and the likelihood (or probability) of such an event occurring. Risk assessment criteria were developed during the 'establish the context' phase of the Risk Management Process (Section 1.3.2) in accordance with AS/NZS ISO 31000:2009.

In accordance with AS/NZS ISO 31000:2009, Tables 1, 2 and 3 were reviewed by Cristal Mining and were considered to be consistent with the specific objectives and context of this PHA.

Table 1
Qualitative Measures of Probability

Event	Likelihood	Description
A	Almost Certain	Happens often
B	Likely	Could easily happen
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Hasn't happened yet but could
E	Rare	Conceivable, but only in extreme circumstances

Source: Safe Production Solutions (2009).

Table 2
Qualitative Measures of Maximum Reasonable Consequence

	People	Environment	Asset/Production
1	Multiple fatalities	Extreme environmental harm (e.g. widespread catastrophic impact on environmental values of an area)	More than $1 billion (B) loss or production delay
2	Permanent total disabilities, single fatality	Major environmental harm (e.g. widespread substantial impact on environmental values of an area)	$100 million (M) to $1B loss or production delay
3	Major injury or health effects (e.g. major lost workday case/permanent disability)	Serious environmental harm (e.g. widespread and considerable impact on environmental values of an area)	$5M to $100M loss or production delay
4	Minor injury or health effects (e.g. restricted work or minor lost workday case)	Material environmental harm (e.g. localised and considerable impact on environmental values of an area)	$250 thousand (k) to $5M loss or production delay
5	Slight injury or health effects (e.g. first aid/minor medical treatment level)	Minimal environmental harm (e.g. minor impact on environmental values of an area)	Less than $250k loss or production delay

Source: Safe Production Solutions (2009).

Combining the probability (Table 1) and consequence (Table 2), Table 3 provides qualitative risk rankings to assess risk levels.

Table 3
Risk Ranking Table

Consequence		Probability				
		A	**B**	**C**	**D**	**E**
	1	1 (H)	2 (H)	4 (H)	7 (M)	11 (M)
	2	3 (H)	5 (H)	8 (M)	12 (M)	16 (L)
	3	6 (H)	9 (M)	13 (M)	17 (L)	20 (L)
	4	10 (M)	14 (M)	18 (L)	21 (L)	23 (L)
	5	15 (M)	19 (L)	22 (L)	24 (L)	25 (L)

Notes: L – Low, M – Moderate, H – High
Rank numbering: 1 – highest risk; 25 – lowest risk

Legend – Risk Levels:

	Tolerable
	ALARP – As low as reasonably practicable
	Intolerable

Source: Safe Production Solutions (2009).

The hazard identification table (Attachment A) illustrates the systematic application of the above criteria for the Project.

2 PROJECT OVERVIEW

The Project would involve two main development components (Figure 1):

1. Construction and development of infrastructure for mining operations at the Atlas and Campaspe deposits (the proposed Atlas-Campaspe Mine).
2. Construction and operation of the Ivanhoe Rail Facility (the proposed Ivanhoe Rail Facility).

The proposed life of the Project is approximately 20 years, commencing approximately 1 July 2013 or upon the grant of all required approvals.

The activities associated with the two main development components of the Project are summarised below.

Atlas-Campaspe Mine

- ongoing exploration activities;
- sequential development and operation of two separate mineral sands ore extraction areas within the Mining Lease Application 1 area;
- use of conventional mobile equipment to mine and place mineral sands ore into dry mining units[1] at a maximum ore production rate of up to 7.2 million tonnes per annum;
- mineral processing infrastructure including the primary gravity concentration unit, salt washing facility and a wet high intensity magnetic separation circuit;
- mineral concentrate stockpiles and materials handling infrastructure (e.g. towers and stackers);
- progressive backfilling of mine voids with overburden behind the advancing ore extraction areas or in overburden emplacements adjacent to the mine path;
- placement of sand residues and coarse rejects (and MSP process wastes[2]) following mineral processing to either the active mining area (behind the advancing ore extraction area) or in off-path sand residue dams;
- development of a groundwater borefield at the Atlas deposit and localised dewatering systems (bores, spearfields and trenches) at both the Atlas and Campaspe deposits, including associated pump and pipeline systems;
- reverse osmosis (RO) plant to supply the salt washing facility and potable water;
- progressive development of water storage dams, sediment basins, pumps, pipelines and other water management equipment and structures;
- administration/office buildings, car parking facilities, workshop and stores;
- on-site accommodation camp;
- sewage treatment plant;
- diesel powered generators, electricity distribution station and associated internal electricity transmission lines;
- site access road, internal access roads and haul roads;
- roadworks along the proposed mineral concentrate transport route to the Ivanhoe Rail Facility;

[1] Mining would use conventional open pit methods and would not involve dredge mining.

[2] Following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project).

- transport of mineral concentrates along the mineral concentrate transport route to the Ivanhoe Rail Facility;
- road transport of MSP process waste[3] in sealed storage containers from the Ivanhoe Rail Facility to the Atlas-Campaspe Mine for subsequent unloading, stockpiling and placement behind the advancing ore extraction areas;
- development of soil stockpiles and laydown areas;
- monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

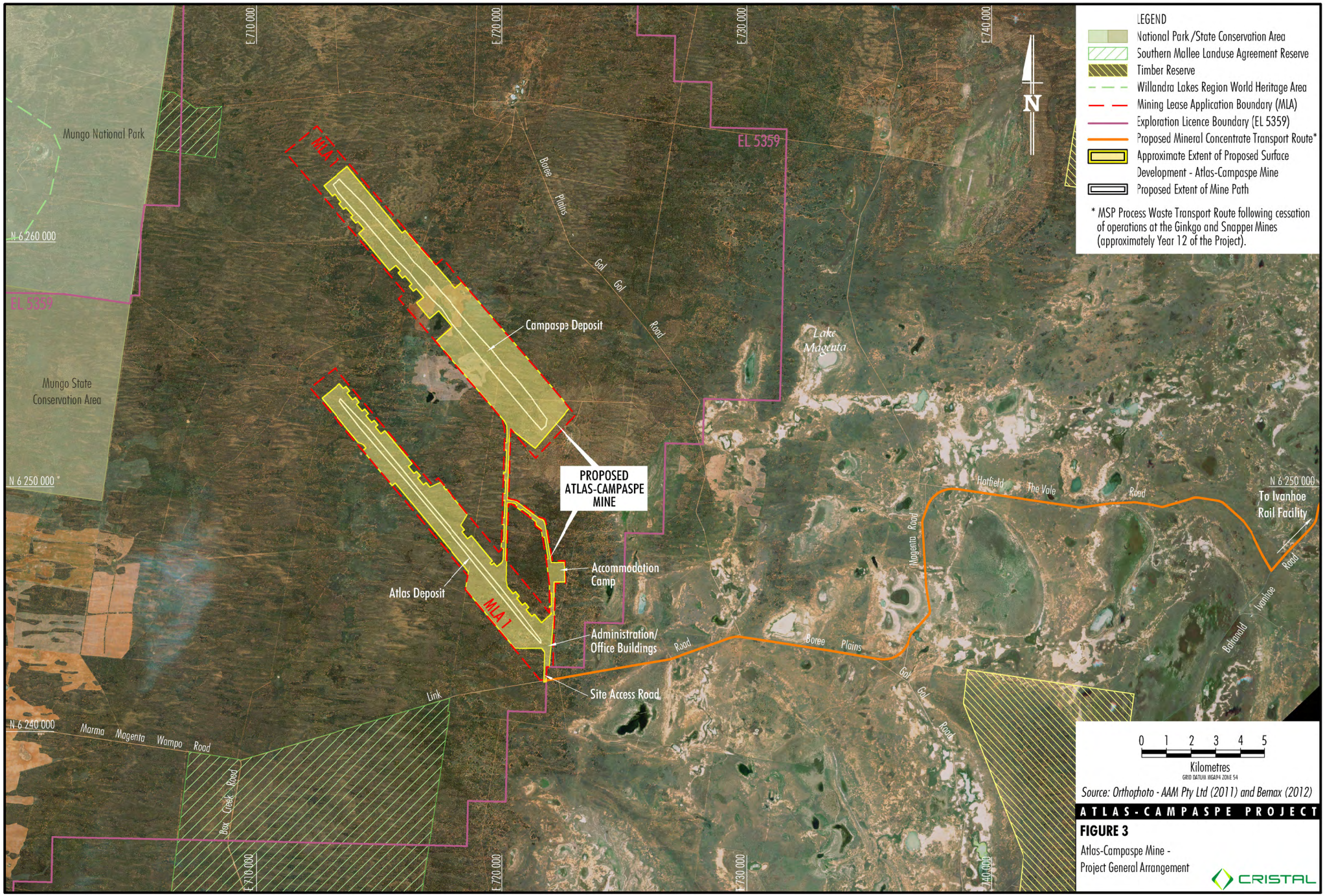
Ivanhoe Rail Facility

- development of a rail siding for:
  - loading of train wagons with mineral concentrate for rail transport to the MSP via the Orange – Broken Hill railway; and
  - unloading of MSP process waste in sealed storage containers (transported via the Orange – Broken Hill railway) from train wagons[3];
- site access road and internal haul roads/pavements;
- hardstand areas for mineral concentrate and MSP process waste[3] unloading, stockpiling/sealed container storage and loading;
- a retention basin, drains, pumps, pipelines and other water management equipment and structures;
- site office, ablutions and car parking facilities;
- extension to existing 11 kilovolt powerline;
- monitoring, landscaping and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

The Project General Arrangements are shown on Figures 3 and 4.

A detailed description of the Project is provided in Section 2 in the Main Report of the EIS.

[3] Following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project).



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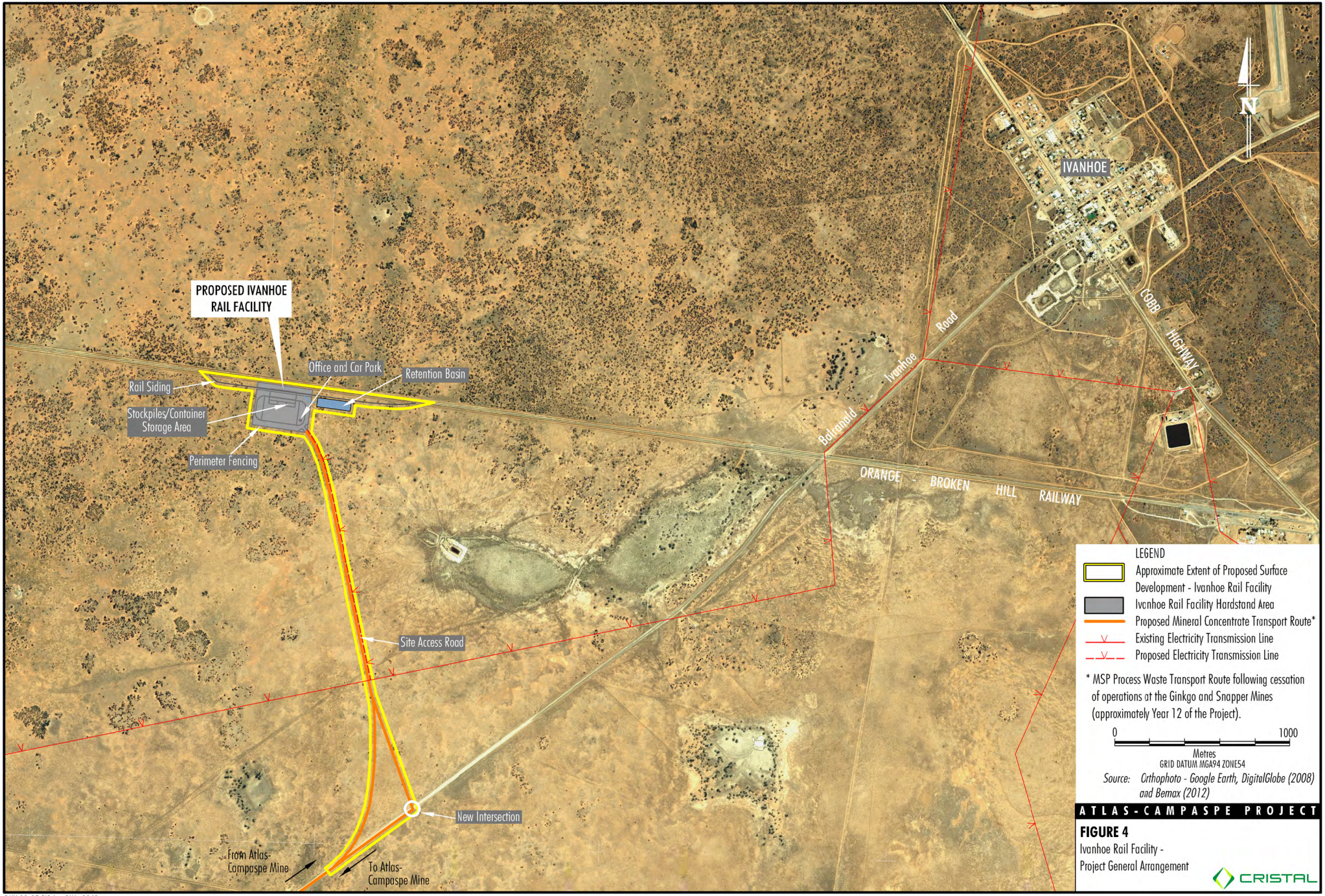

ATLAS-CAMPASPE PROJECT

FIGURE 4

Ivanhoe Rail Facility - Project General Arrangement

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3 HAZARD IDENTIFICATION

3.1 DESCRIPTION OF HAZARDOUS MATERIALS

The major potentially hazardous materials associated with the Project include MSP process waste, hydrocarbons and chemicals. A brief description of these materials is presented below.

3.1.1 Mineral Separation Plant Process Waste

All heavy mineral sands orebodies contain traces of the naturally occurring radioactive elements uranium and thorium together with their decay products. The only mineral sands component that is significantly radioactive is monazite. Monazite is a radioactive material containing cerium, lanthanum and neodymium and is a source of the radioactive element thorium (Bemax, 2006).

A Mineral Concentrate and Process Waste Materials Assessment (Appendix L of the EIS) has been prepared for the Project, and has classified the MSP process waste as "hazardous" in accordance with the *Waste Classification Guidelines Part 3: Waste Containing Radioactive Material* (DECC, 2008) and as a "Radioactive Substance" under the NSW *Radiation Control Act, 1990*.

The maximum quantity of MSP process waste (from the processing of Project mineral concentrate) transported to the Atlas-Campaspe Mine for disposal would be approximately 50,000 tonnes per annum.

The management measures relevant to the MSP process waste are provided in the Mineral Concentrate and Process Waste Materials Assessment (Appendix L of the EIS).

3.1.2 Hydrocarbons

Hydrocarbons proposed for use at the Project include fuels (diesel and petrol), oils, greases, degreaser and kerosene.

Diesel

Diesel is classified as a combustible liquid by AS 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids* (AS 1940:2004) (Class C1) for the purpose of storage and handling, but is not classified as a dangerous good by the criteria of the Australian Dangerous Goods (ADG) Code (National Transport Commission, 2007). In the event of a spill, diesel is damaging to soils and aquatic ecosystems and fires can occur if ignited (flash point 61 to 150 degrees Celsius).

The risks associated with the Project include diesel storage and usage. Diesel storage facilities at the Atlas-Campaspe Mine would include two 60,000 litre (L) above ground tanks stored within a fuel storage facility. A concrete bund would surround the tanks whereby rainfall and any spilt fuel within the bunded area would be directed to a collection sump whereby it would be pumped to a collection sump whereby it is removed by a licensed contractor.

The Ivanhoe Rail Facility would also incorporate diesel storage facilities. One 1,000 L above ground tank would be located within a concrete bund whereby rainfall and any spilt fuel within the bunded area would be directed to a collection sump for collection and disposal by a licensed contractor.

The diesel storage facilities at the Project would be operated in accordance with the requirements of AS 1940:2004, as would any upgrades to these facilities over the Project life.

Petrol

Petrol is classified as a flammable liquid (Class 3) by AS 1940:2004 and as such is classified as a dangerous good by the criteria of the ADG code. On-site petrol usage would be minor, with a 1,000 L above ground tank also located within the fuel storage facility at the Atlas-Campaspe Mine.

Oils, Greases, Degreaser and Kerosene

Oil is classified as a combustible liquid (Class C2) by AS 1940:2004.

Used engine oils (lubricating oils) and hydraulic oils would be recovered during plant and vehicle servicing in the workshop (at both the Atlas-Campaspe Mine and the Ivanhoe Rail Facility) and in the field. Within the workshop area, a separate bunded area would hold a waste oil tank and oil/grease drums.

All contractors would be required to manage and remove from site all waste oil generated during their operations. Waste hydrocarbons and oil filters would be collected, stored and removed from site by licensed contractors.

Small quantities of grease, degreaser and kerosene would also be required. Procedures would be developed for the handling, storage, containment and disposal of workshop hydrocarbons (i.e. oils, greases, degreaser and kerosene) in accordance with AS 1940:2004.

3.1.3 Chemicals

The management and storage of chemicals at the Project site would be conducted in accordance with appropriate management procedures, Australian Standards and codes.

All chemicals brought on-site for use at the Project site would be recorded in inventory registers at the Atlas-Campaspe Mine and the Ivanhoe Rail Facility.

No chemicals or hazardous materials would be permitted on-site unless a copy of the appropriate materials safety data sheet (MSDS) is available on-site or, in the case of a new product, it is accompanied by a MSDS.

Appropriate management measures would be developed to cover the use of all chemicals at the Project. These management measures would include on-site handling, storage and use of these chemicals in accordance with the relevant MSDSs.

3.2 HAZARD IDENTIFICATION PROCESS

3.2.1 Project Components

As this assessment specifically covers risks from fixed installations (in accordance with DoP [2011a] [Section 1.1]), the main focus of this assessment was on-site storages at the Project, the primary gravity concentration unit, the heavy mineral concentrate treatment facility (incorporating the silt washing facility, wet high intensity mineral separation circuit and RO plant) and the mineral concentrate stockpiles.

3.2.2 Incident Classes

The following generic classes of incident were identified:

- leaks/spills;
- fire;
- explosion;
- theft;
- accident; and
- unplanned movement off-site.

3.2.3 Project Risk Treatment Measures

A number of hazard control and mitigation measures would be described in management plans for the Project, including the following:

- Mining Operations Plan.
- Environmental Management Strategy.
- Water Management Plan.
- Biodiversity Management Plan.
- Offset Management Plan.
- Heritage Management Plan.
- Air Quality and Greenhouse Gas Management Plan.
- Noise Management Plan.
- Radiation Management Plan.
- Radioactive Waste Management Plan.
- Mineral Concentrate and MSP Process Waste Transport Management Plan.
- Rehabilitation Management Plan.
- Mine Closure Plan.
- Construction Environmental Management Plan – Ivanhoe Rail Facility.
- Operational Environmental management Plan – Ivanhoe Rail Facility.

In addition, the following hazard treatment measures would be adopted for the Project:

- **Engineering Structures** – Mining and civil engineering structures would be constructed in accordance with applicable codes, guidelines and Australian Standards. Where applicable, Cristal Mining would obtain the necessary licences and permits for engineering structures.
- **Contractor Management** – All contractors employed by Cristal Mining would be required to operate in accordance with the relevant Australian Standards and NSW legislation.
- **Storage Facilities** – Storage and usage procedures for potentially hazardous materials (i.e. fuels and lubricants) would be developed in accordance with Australian Standards and relevant legislation.
- **Emergency Response** – Emergency response procedures manuals and systems would be implemented.

- **Maintenance** – On-going and timely maintenance of all mobile and fixed plant and equipment in accordance with the manufacturer's recommended maintenance schedule, and consistent with the maintenance schemes required by relevant standards. Only vehicles permitted to carry dangerous goods would be used for the transport of hazardous materials.
- **Staff Training** – Operators and drivers would be trained and (where applicable) licensed for their job descriptions. Only those personnel licensed to undertake skilled and potentially hazardous work would be permitted to do so.

4 RISK MANAGEMENT AND EVALUATION

Attachment A presents a qualitative assessment of risks associated with the construction and operation of the Project. As described in Section 1.1, the assessment focuses on fixed installations and evaluates the off-site risks of the Project with potential to impact on the environment, members of the public and their property.

For this PHA, the 'site' was considered to be consistent with the Development Application area which is provided in Attachment 2 of the EIS.

Hazard treatment measures have been proposed, where required, to produce a 'low' level of risk in accordance with the risk acceptance criteria described in Section 1.3.4. Proposed hazard control and mitigation measures are identified in Section 3.2.3.

In accordance with *Multi-Level Risk Assessment* (DoP, 2011a) and *HIPAP No. 4: Risk Criteria for Land Use Safety Planning* (DoP, 2011c), the results of the PHA indicate:

- residual risk levels are tolerable with respect to surrounding land uses and do not preclude approval of the Project; and
- societal risk (based on a Level 1 assessment) is negligible.

5 REFERENCES

Bemax Resources Limited (2006) *Broken Hill Mineral Separation Plant Waste Management Plan.*

Department of Environment and Climate Change (2008) *Waste Classification Guidelines Part 3: Waste Containing Radioactive Material*.

Department of Planning (2008) *Applying SEPP 33 (Consultation Draft).*

Department of Planning (2011a) *Multi-Level Risk Assessment.*

Department of Planning (2011b) *Hazardous Industry Planning Advisory Paper No. 6: Hazard Analysis.*

Department of Planning (2011c) *Hazardous Industry Planning Advisory Paper No. 4: Risk Criteria for Land Use Safety Planning.*

National Transport Commission (2007) *Australian Dangerous Goods Code*.

Safe Production Solutions (2009) *Illawarra Coal Holdings Bulli Seam Operations Environmental Risk Assessment*.

ATTACHMENT A

PROJECT HAZARD IDENTIFICATION TABLE

Atlas-Campaspe Mineral Sands Project Hazard Identification Table

Project Component	Incident Type	Scenario	Proposed Preventative Measures	Likelihood[1]	Consequence[2]	Risk[3]
On-Site Storage Process waste, hydrocarbons (i.e. fuels [diesel and petrol], oils, greases, degreaser and kerosene) and chemicals	Leak/Spill	Operator error leading to off-site dispersal of stored process waste of hydrocarbons.	• Design of road transport tubs to relevant standards and legislation. • Regular inspections and maintenance. • Spill management equipment (i.e. spill kits) located on-site. • Spill management procedures and training. • Operator induction and ongoing training. • Operational procedures (including traffic safety). • Driver Training. • Signage. • Health and Safety Management System. • Contractor Management Standard. • Site policies, management plans and procedures.	D	4	21(L)
		Failed tank or associated fittings, pump or pipework or operator error leading to off-site impacts including chemical or fuel contamination.	• Design of structures/tanks/pipes to relevant standards and legislation. • Bunds designed to divert spills to containment structures. • Appropriate storage of all chemicals, fuel and dangerous substances in accordance with relevant Australian Standards and legislation. • Loss detection systems. • Regular inspections and maintenance. • Spill management equipment (i.e. spill kits) located on-site. • Spill management procedures and training. • Operator induction and ongoing training. • Operational procedures. • Dangerous goods register and MSDSs kept on-site. • Signage. • Health and Safety Management System. • Contractor Management Standard. • Site policies, management plans and procedures.	E	4	23(L)

Atlas-Campaspe Mineral Sands Project Hazard Identification Table (Continued)

Project Component	Incident Type	Scenario	Proposed Preventative Measures	Likelihood[1]	Consequence[2]	Risk[3]
On-Site Storage (Cont.) Process waste, hydrocarbons (i.e. fuels [diesel and petrol], oils, greases, degreaser and kerosene) and chemicals	Leak/Spill	Failed storage vessel due to mechanical impact or corrosion leading to off-site impacts including chemical or fuel contamination.	• Protection of storage facilities (e.g. bollards). • Storage tanks located to minimise potential impacts of leaks/spills. • Appropriate storage of all chemicals, fuel and dangerous substances in accordance with relevant Australian Standards and legislation. • Design of structures/tanks/pipes to relevant standards and legislation. • Bunds designed to divert spills to containment structures. • Loss detection systems. • Regular inspections and maintenance. • Spill management equipment (i.e. spill kits) located on-site. • Spill management procedures and training. • Operator induction and ongoing training. • Operational procedures. • Dangerous goods register and MSDSs kept on-site. • Signage. • Health and Safety Management System. • Contractor Management Standard. • Site policies, management plans and procedures.	E	4	23(L)
	Accident	Vehicle crash leading to spill.	• Operator induction and ongoing training. • Operational procedures (including traffic safety). • Driver Training. • Health and Safety Management System. • Contractor Management Standard. • Site policies, management plans and procedures.	D	4	21(L)

Atlas-Campaspe Mineral Sands Project Hazard Identification Table (Continued)

Project Component	Incident Type	Scenario	Proposed Preventative Measures	Likelihood[1]	Consequence[2]	Risk[3]
On-Site Storage (Cont.) Process waste, hydrocarbons (i.e. fuels [diesel and petrol], oils, greases, degreaser and kerosene) and chemicals	Fire or Explosion	Poor maintenance, poor design, collision or human error leading to off-site fire/explosion/ fume related impacts.	• Design of structures/tanks/pipes to relevant standards and legislation. • Appropriate storage of all chemicals, fuel and dangerous substances in accordance with relevant Australian Standards and legislation. • Housekeeping activities – site would be kept clean and tidy and fire hazards removed where practicable. • Availability of fire fighting equipment. • Regular inspections and maintenance of fire fighting equipment and storage areas, where required. • Site policies, management plans and procedures. • Protection of storage facilities (e.g. bollards). • Operator induction and ongoing training. • Health and Safety Management System. • Contractor Management Standard.	D	5	24(L)
	Theft	Theft or malicious act/sabotage resulting in off-site impacts.	• Restriction of access to storage areas, including securing storage facilities. • Provision of adequate lighting around storage facilities. • Signage (i.e. unauthorised entry warning and information signs). • Police would be informed as soon as possible. • Health and Safety Management System. • Contractor Management Standard.	C	5	22(L)

Atlas-Campaspe Mineral Sands Project Hazard Identification Table (Continued)

Project Component	Incident Type	Scenario	Proposed Preventative Measures	Likelihood[1]	Consequence[2]	Risk[3]
Mining Operations	Unplanned movement off-site	Mobile plant or equipment parts move off-site in an uncontrolled manner.	• Operational activities undertaken by appropriately licensed and competent personnel. • Planning of activities to minimise potential for off-site impacts. • Supervision by appropriately qualified persons (e.g. Safety Officer).	D	4	21(L)
		MSP process waste moves off-site in an uncontrolled manner.	• Operational procedures. • Implementation of appropriate controls (e.g. sprinklers/bunding). • Planning of activities to minimise potential for off-site impacts. • Supervision by appropriately qualified persons. • Site policies, management plans and procedures.	D	4	21(L)
	Fire	On-site incident leading to off-site fire.	• Mandatory fire breaks along all fencelines. • Fire breaks maintained annually. • Agreement with Rural Fire Service. • Training of site personnel in fire fighting techniques. • Regular maintenance of on-site fire fighting equipment. • Access restrictions to active mining areas. • Site policies, management plans and procedures.	D	3	17(L)

Atlas-Campaspe Mineral Sands Project Hazard Identification Table (Continued)

Project Component	Incident Type	Scenario	Proposed Preventative Measures	Likelihood[1]	Consequence[2]	Risk[3]
Other infrastructure and supporting systems	Leak/spill	Spill of waste oil, sewage wastes or domestic wastes leading to off-site impacts.	• Waste oil stored in accordance with Australian Standards. • Sewage treatment facilities registered with local council. • Storage tanks located to minimise potential impacts of leaks/spills. • Licensed contractor to remove waste oil and domestic waste from site for disposal. • Spill management equipment (i.e. spill kits) located on-site. • Spill management procedures and training. • Operator induction and ongoing training. • Induction on recycling and disposal methods used at the site. • Dangerous goods register and MSDSs kept on-site. • Health and Safety Management System. • Contractor Management Standard.	D	4	21(L)
	Leak/spill	Dam failure/leak leading to off-site spillage of saline water.	• Design of dams in accordance with Dams Safety Committee requirements. • Consideration of geotechnical studies in dam design. • Construction and management of dams to maintain a minimum of one metre freeboard.	D	4	21(L)
	Leak/spill	Pipeline failure leading to off-site spillage of saline water.	• Inspection of integrity of pipeline. • Maintenance procedure for pipeline to ensure integrity at completion of works. • Validation checks of pipeline works. • Pipelines to remain in bunded corridors.	D	5	24(L)

[1] Refer to Table 1.

[2] Refer to Table 2.

[3] Refer to Table 3.

MSDS = materials safety data sheet.