Appendix 18

Preliminary Hazard Analysis

UNITED WAMBO OPEN CUT COAL MINE PROJECT

Preliminary Hazard Analysis

FINAL

July 2016

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FINAL

Prepared by

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on behalf of

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Executive Summary

The United mine and Wambo mine are neighbouring existing coal mining operations situated approximately 16 kilometres (km) west of Singleton in the Hunter Valley of New South Wales (NSW). The two mines have formed a Joint Venture and propose to develop the United Wambo Open Cut Coal Mine Project (the Project) that combines the existing open cut operations at Wambo with a proposed new open cut coal mine at United.

The Project includes open cut mining operations in two areas for a period of approximately 23 years; the proposed United Open Cut and modified operations in the approved Wambo Open Cut. The Project is anticipated to deliver up to 10 million tonnes per annum of run-of-mine coal production from the combined open cut operations.

The existing mining operations currently store and use a range of hazardous materials, including explosives. Some of the existing storage locations will change as a result of the Project as will the quantities of materials used at the site annually. However, the maximum inventory of hazardous materials to be stored at the Project will remain unchanged from the existing approved Wambo mine. This Preliminary Hazard Analysis (PHA) assesses the anticipated changes to the storage and transport of hazardous materials associated with the Project in accordance with State Environmental Planning Policy 33 Hazardous and Offensive Development (SEPP 33).

The Project was identified as being potentially hazardous with respect to the storage of both Class 5.1 oxidising materials and Class 1.1 explosive materials. The assessment has concluded that the risks to off-site land users associated with the relocated storage facilities will be tolerable with the planned buffer zones from the Wambo and United land ownership boundary in place.

The transport of Class 5.1 materials to the Project was found to trigger SEPP 33 screening thresholds requiring a route selection study to be undertaken. The existing deliveries to the site also trigger the screening thresholds and no changes are proposed to the routes or maximum daily tonnages, with the only change relating to the total annual tonnages. Relative risks for two alternate routes for the transport of technical grade ammonium nitrate (TGAN) from Kooragang Island to the Project were estimated. Relative risks for the transport of ammonium nitrate emulsion (ANE) from two representative supply locations to the Project were estimated.

The Route Selection study indicates that the levels of risk associated with the ANE transport from the two representative supply locations are approximately equal.

It is noted that the Project will not have direct control over the delivery of hazardous materials to the mining operations as it will be undertaken by a supply contractor. To assist in mitigating transport risk, the Project will select hazardous materials supply contractors that are approved carriers of dangerous goods and have suitable safety management systems to provide for the safe transport of hazardous materials.

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1.0 Introduction

The United and Wambo mines are neighbouring mining operations located approximately 16 kilometres (km) west of Singleton in the Hunter Valley region of New South Wales (NSW) (refer to **Figure 1.1**). United Collieries Pty Limited (United) the operator of United mine and Wambo Coal Pty Limited (Wambo) the operator of Wambo mine, have formed a Joint Venture which includes the proposed development of the United Wambo Open Cut Coal Mine Project (the Project).

The Project proposes open cut coal mining for a period of 23 years, with mining in a new open cut mine at United (the United Open Cut) combined with ongoing mining at the existing, approved Wambo Open Cut under a modified mine plan. The Project will optimise future mining operations across these two adjoining open cut mining areas, maximising coal recovery and the efficient use of existing mining infrastructure, while providing the operational flexibility required to actively manage the mine to minimise environmental impacts.

The Project is State Significant Development as defined under State Environmental Planning Policy (State and Regional Development) 2011 and requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project will also require a modification to the existing Wambo development consents under section 75W of the EP&A Act to harmonise these consents with the Project. An Environmental Impact Statement (EIS) has been prepared to accompany these applications.

This Preliminary Hazard Analysis (PHA) has been prepared by Umwelt (Australia) for the EIS for the Project. The PHA has been undertaken in accordance with the Secretary of the Department of Planning and Environment's Environmental Assessment Requirements (SEARs) issued on 15 December 2015, and:

- *State Environmental Planning Policy 33* (SEPP 33) – *Hazardous Industry and Offensive Development* (Department of Planning (DoP), 1992)
- *Hazardous Industry Planning Advisory Paper* (HIPAP) *6 – Guidelines for Hazard Analysis* (DoP, 2011)
- *HIPAP 11 – Route Selection* (DoP, 2011).

FIGURE 1.1

Locality Plan

2.0 Project Overview

Mining has been occurring at Wambo since the late 1960's and at United since 1989, with both mines previously undertaking both open cut and underground mining operations. Over this time the two mines have regularly cooperated, including sharing access to coal resources where appropriate, to provide for more efficient recovery of the State's coal resources. The two mines have also shared some mining infrastructure, including the joint use of the Wambo train loading facility, and share water to minimise external water demand.

Building on this long history of cooperative operations, in November 2014 United and Wambo announced a 50:50 Joint Venture between the two companies. The Joint Venture agreement outlines how the two companies will work together to further develop open cut coal resources held by the two mines.

Whilst open cut coal mining has previously been undertaken at United, over the last two decades the focus has been on underground mining. Underground longwall mining operations were approved to provide up to 2.95 million tonnes per annum (Mtpa) of saleable coal. Mining operations were suspended at United in March 2010 with the mine entering a period of care and maintenance. At that time, exploration and pre-feasibility works were commenced to determine the potential for future mining activities within United's mining lease. Ongoing exploration has identified substantial reserves of coal suitable for open cut mining.

Ongoing open cut and underground mining is occurring at Wambo, with the mine having approval to extract up to 8 million tonnes per annum (Mtpa) of run of mine (ROM) coal by open cut methods. The combined Wambo underground and open cut operations have approval to extract up to 14.7 Mtpa ROM coal, and to transport up to 15 Mtpa of product coal via the train loading facility.

As discussed above, the Project includes open cut mining operations in two areas, the proposed United Open Cut and modified operations in the approved Wambo Open Cut for a period of approximately 23 years. The existing Wambo Open Cut has approval for continued open cut mining until March 2017 (with a modification lodged to extend this to 2020). Due to the progression of mining being slower than originally planned, there will be substantial coal resources remaining in this approved mining area at March 2017 and the Project proposes to continue mining in this approved area. The Project also seeks some minor extensions to the approved Wambo Open Cut surface mining area and will seek approval to mine deeper resources below the approved Wambo Open Cut area.

The Project will produce up to 10 Mtpa of ROM coal. The existing Wambo CHPP and train loading facility will be utilised for the Project. These facilities will also continue to receive coal from the ongoing Wambo underground mine (that is not the subject of this Project).

The Project also requires a number of changes to the layout of existing mining, public and private infrastructure within the Project Area.

The key aspects of the Project are shown on **Figure 2.1** and a summary of the key Project details is provided in **Table 2.1**.

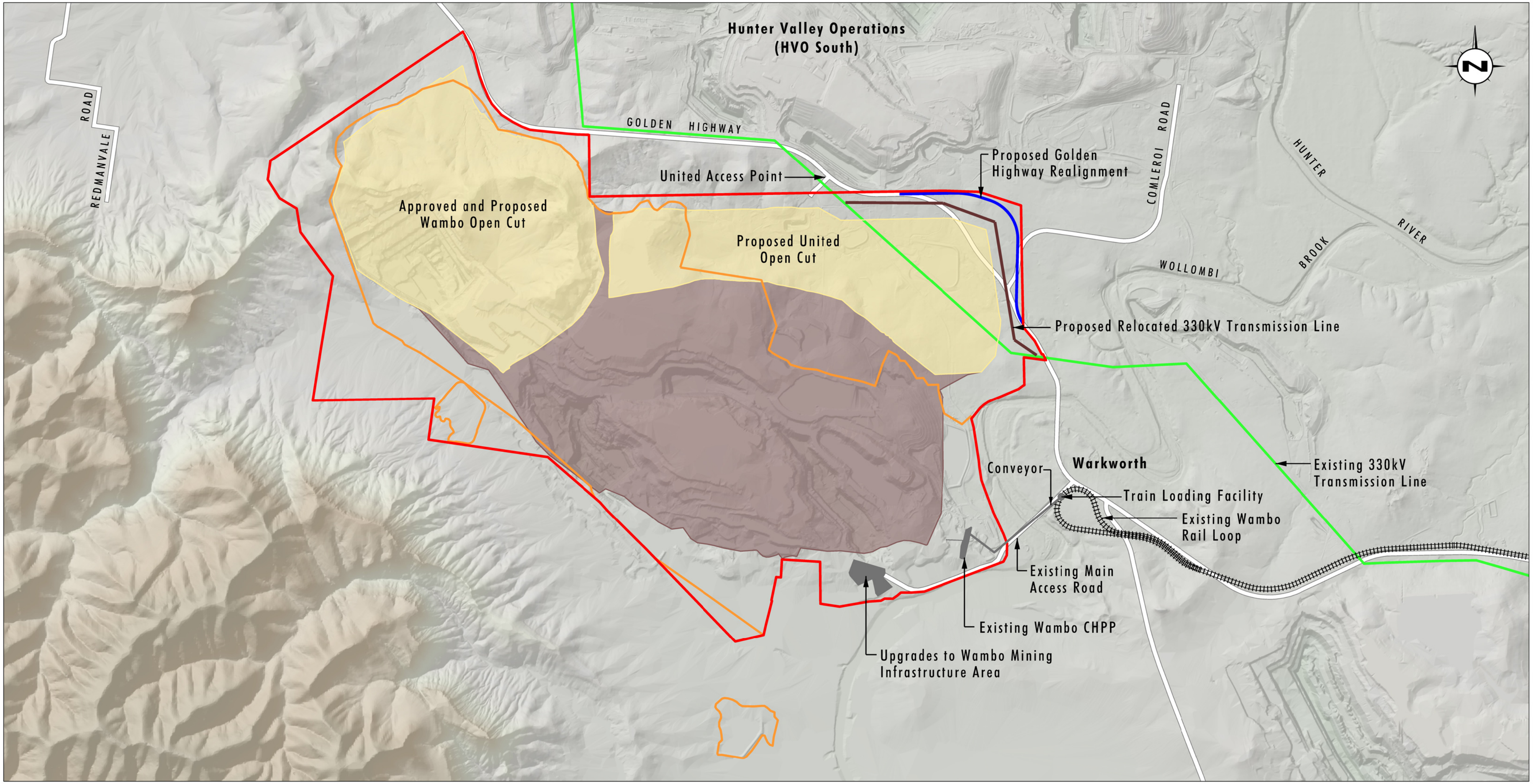

Image Source: United LiDAR (2015)
Data Source: Glencore (2015)

Legend

- Project Area
- Proposed Conceptual Extraction Area
- Active Mining Area
- Approved Wambo Surface Development Area
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line

FIGURE 1.2

Overview of The Project

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Table 2.1 Summary of Key Project Details

Key Project Components/Aspects	Proposed Operations
Key feature of the Project	The operation of a multi-seam open cut mining operation integrating the existing and approved Wambo Open Cut under a modified mine plan and the proposed United Open Cut.
Total Economically Recoverable Reserve	Approximately 176 Mt of ROM coal recovered from the two open cut mining operations, made up of: • approximately 110 Mt of ROM coal from the United Open Cut • approximately 66 Mt of ROM coal in total from the Wambo Open Cut, including an additional 40 Mt accessed from the increased depth of mining.
Extraction Rates	Up to 10 Mtpa ROM coal.
Life-of- Mine	Approximately 23 years from the date of Project approval.
Operating Hours	24 hours per day, 7 days per week.
Number of Employees	Up to approximately 500 total operational positions (at peak production).
Mining Methods	Open cut mining using a truck and excavator/shovel fleet.
Extent of Mining Areas	Refer to **Figure 2.1** for the proposed extent of open cut mining. The Project proposes to modify the Wambo Open Cut boundary to maximise resource recovery. The modification to the approved Wambo Open Cut boundary will result in a minor surface adjustment of approximately 3.8 hectares of additional disturbance. The modification also includes accessing deeper seams within the existing Wambo Open Cut.
Infrastructure	Initial use and upgrades of existing United Mine Infrastructure Area prior to its decommissioning and demolition/removal due to the progression of the United Open Cut. Construction of temporary facilities during the construction phase of the Project. Ongoing use, expansion and upgrade of the Wambo Mining Infrastructure Area. Use of existing Wambo CHPP and train loading facility within their currently approved annual capacities of 14.7 Mtpa ROM coal and 15 Mtpa product coal respectively.

Key Project Components/Aspects	Proposed Operations
Tailings and Rejects Strategy	Decommissioning and capping of existing tailings storage facilities located in areas proposed for overburden emplacement and ongoing use of existing tailings storage facilities and storages established in other mine voids as required. Coarse rejects from coal preparation to be transported by truck to the open cut overburden areas for emplacement and subsequent covering by overburden material. Coarse rejects will continue to be co-disposed within the open cut overburden areas for the life of operations.
External Coal Transport	Product coal will continue to be transported off site via train from the existing Wambo train loading facility. Product coal transport rates proposed to increase from a maximum of six to eight trains per day. No change to total approved 15 Mtpa product coal tonnage transported by train.
Roads	Realignment of a 2 kilometre section of the Golden Highway to accommodate the proposed United Open Cut. The main entrance to the Project will be via the existing entrance to Wambo. The existing United access road will be used in the initial phase of the Project for construction and ancillary services with limited ongoing use as a property access point.
Power Infrastructure	An existing 330 kV transmission line which traverses the proposed United Open Cut mining area is proposed to be relocated as part of the Project (refer to **Figure 2.1**). Several other 66 kV and 11kV power lines will also require relocation to outside of proposed mining areas. Some existing telecommunications and associated infrastructure are located adjacent to the existing alignment of the Golden Highway and will also require relocation as part of the Project.
Water Management	Construction of mine water management controls including dams. Use of the previously mined United underground voids for water storage.

United is owned 95 per cent by Abelshore Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore) and 5 per cent by the Construction, Forestry, Mining and Energy Union (CFMEU) and is managed by Glencore. Wambo is a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

The maximum inventory of hazardous materials to be stored at the Project will remain unchanged from that stored at the existing approved Wambo. However, the hazardous materials storages may require relocation over the life of the Project due to the progression of the mine and to meet operational needs.

The frequency and quantity of hazardous materials transported to the Project will increase by approximately 25% per annum to cater for the increased consumption associated with the higher open cut coal extraction rates. The maximum tonnes delivered on any given day are not expected to change.

3.0 Statutory Requirements

Under *SEPP 33 – Hazardous and Offensive Development* (DoP, 1992), a preliminary risk screening of the proposed development is required to determine the need for a Preliminary Hazard Analysis (PHA). The preliminary screening involves identification and assessment of the storage of specific dangerous goods classes that have the potential for significant off-site effects. If, at the proposed location, and in the presence of controls the risk level exceeds the acceptable criteria for impacts on the surrounding land use, the development is classified as a 'hazardous' and/or 'offensive' industry as appropriate and may not be permissible within certain land zones in NSW.

A 'hazardous industry' under SEPP 33 is one which, when all locational, technical, operational and organisational safeguards are employed continues to pose a significant risk. An 'offensive industry' is one which, even when controls are used, has emissions which result in a significant level of offence e.g. odour or noise emissions. A proposal cannot be considered either hazardous or offensive until it is firstly identified as potentially hazardous or offensive and subjected to the assessment requirements of SEPP 33. A PHA is required if a proposed development is potentially hazardous.

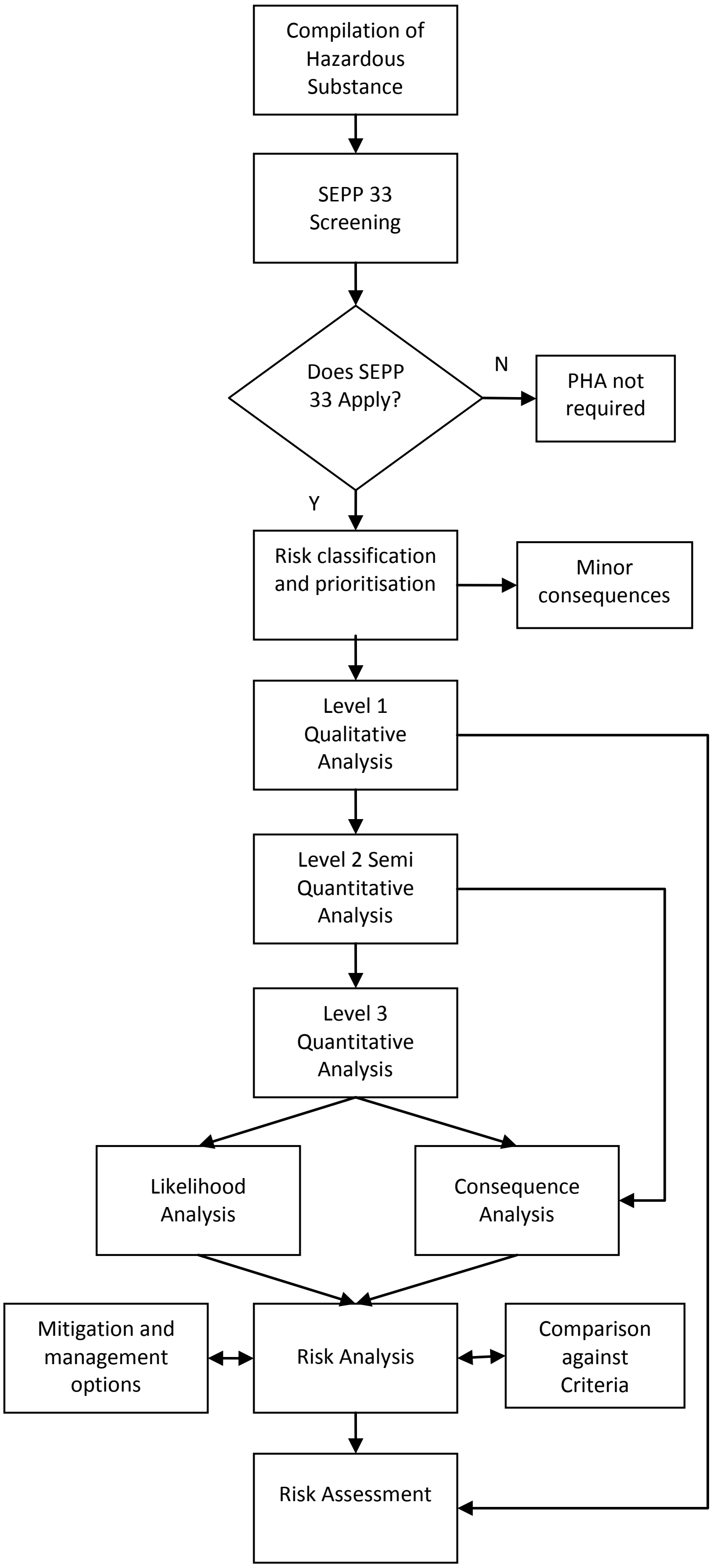
A proposed development may also be potentially hazardous if the number of traffic movements for the transport of hazardous materials exceeds the annual or weekly criteria outlined in Table 2 of *Applying SEPP 33* (DoP 2011). If these thresholds are exceeded a route evaluation study is likely to be required.

When a PHA is required, *HIPAP No. 6 – Guidelines for Hazard Analysis* (DoP, 2011) and *Multi-level Risk Assessment* (DoP, 2011) note that the PHA should identify and assess all hazards that have the potential for off-site impact. The expectation is that the hazards would be analysed to determine the consequence to people, property and the environment and their potential to occur.

The methodology used to identify and assess the hazards and respective failure scenarios that have the potential for off-site impact is outlined in **Figure 3.1**. The details of how this methodology is implemented are discussed in the respective sections of this report.

In summary, the risk assessment involves the following processes:

- identifying the risks to be managed, including:
    - a preliminary risk screening (refer to **Section 4.0**)
    - classification and prioritisation of risks.
- analysis of the risks involved with the Project, including sources, consequences, and likelihood of consequences
- assessment of risk by evaluating the results of the hazard analysis. This involves comparison of analysed risks with risk criteria as identified in *HIPAP No. 4 – Risk Criteria for Land Use Safety Planning* (DoP 2011)
- treatment of risks, including identification and assessment of safeguards and treatment plans.



SEPP 33 Screening involves compiling information on the quantity of hazardous materials used, the mode of storage and location with respect to the site boundary and the number and size of annual and weekly road movements of the hazardous material.

A proposed development should be considered potentially hazardous if the storage or transport of hazardous substances exceeds the respective screening thresholds.

Risk classification and prioritisation involves ranking of the facility using techniques to make broad estimates of the consequence and likelihood of accidents. The output is expressed in terms of individual and societal risk and is compared against respective criteria.

A Level 1 analysis is a qualitative assessment based on detailed hazard identification. The objective is to demonstrate that the activity does not pose a significant risk. Where the qualitative analysis cannot satisfactorily demonstrate there will be no significant risk, further analysis is required.

A Level 2 analysis supplements the Level 1 analysis by quantifying the main risk contributors to show that their consequences are acceptable.

A Level 3 quantitative analysis is required when the screening and hazard identification process and/or risk classification and prioritisation process has identified risk contributors with consequences beyond the site boundaries. The analysis requires a comprehensive quantification of significant consequences and their likelihood.

The Risk Assessment compares the results of the risk analysis with the respective risk criteria. Where the level of risk is not acceptable, risk minimisation, mitigation and management options need to be investigated.

Figure 3.1

Overview of PHA Methodology

4.0 Preliminary Risk Screening

Preliminary risk screening is undertaken to determine if a PHA is required. The preliminary risk screening compares the proposed hazardous material storage quantities that have the potential to create off site impacts with SEPP 33 screening thresholds.

4.1 Storage Quantity Screening

Hazardous materials will continue to be stored at the existing Wambo storage facilities. The maximum stored quantities of hazardous materials will remain unchanged from existing approved quantities, specified in Dangerous Goods Licence XSTR100145 and Addendum XSTR100150. However, the storage facilities may be relocated during the life of the Project due to the progression of the mining operation. Therefore, there is the potential for the level of risk posed to off-site land users to change from present risk levels. **Table 4.1** presents the hazardous materials inventories for the Project which are unchanged from the existing approved Wambo operation.

Table 4.1 Hazardous Materials Inventory

Material	Dangerous Goods Class	Storage Type	Maximum Inventory	Screening Threshold	
				Quantity	Triggers SEPP 33
Ammonium Nitrate Emulsion	5.1	3 above ground tanks	120 T	5 T	Yes
Ammonium Nitrate	5.1	Roofed store	400 T	5 T	Yes
Detonator Assemblies (non-electric)	1.1B	External Magazine	30,000 units (approx 1.8 T)	12 T at 320 m from site boundary	No (See note 1)
Boosters **Detonating Cord** **Explosive, Blasting, Type E**	1.1D	External Magazine	10 T		
Detonators (electric)	1.4B	External Magazine	1,000 units (approx 60 kg)	N/A[2]	N/A[2]
Diesel	C1	Above ground tanks	370 kL	N/A[3]	N/A[3]

Material	Dangerous Goods Class	Storage Type	Maximum Inventory	Screening Threshold	
				Quantity	Triggers SEPP 33
Lubricants (Engine Oil and Transmission Oil)	C2	Above ground tanks	57 kL	N/A[3]	N/A[3]

Note 1: The SEPP 33 screening threshold will be triggered if the magazine were to be located within 320 m of the site boundary.

Note 2: Screening thresholds are not applicable to Class 1.4B materials.

Note 3: Screening thresholds are not applicable to Class C1 or C2 materials.

In addition to the materials listed in **Table 4.1** minor quantities of Class 3 flammable liquids such as paints, all purpose thinners and degreasers are likely to be stored at the Project. The quantities stored will not trigger the SEPP 33 screening thresholds for either Class 3 packaging group (PG) I (2 tonnes at a distance of 3 metres from the site boundary) or Class 3 PG II and PG III (5 tonnes at a distance of 3 metres from the site boundary) flammable liquids.

All flammable and combustible liquids (including minor quantities of flammable liquids) will be stored and handled in accordance with *AS 1940 – 2004 The storage and handling of flammable and combustible liquids*. The management of hydrocarbon storage and handling will also be governed by the Glencore Hydrocarbon Protocol CAA HSEC PCL 0009 – 11.07 Hydrocarbon Management which focuses on the environmental aspects of hydrocarbon management.

As the approved maximum quantity of 520 tonnes of Class 5.1 materials exceeds the SEPP 33 trigger threshold of 5 tonnes, the Project is considered potentially hazardous and therefore this PHA has been prepared.

United has identified that it may be necessary to relocate the hazardous materials storage facilities as the mining operation progresses. This relocation would be undertaken to provide ready access to these materials for use in the mining operations and to allow for ongoing development of the overburden emplacement areas. The facilities, when relocated, would be relocated into a suitable location within the Project mining area. A number of relocations may be required over the life of the Project. Therefore, this hazard analysis has been undertaken to identify the required buffer distances between the hazardous materials stores and land ownership boundary to ensure the risks posed to the surrounding land users are tolerable. When the hazardous materials storage facilities are relocated it will be to a location within the Project mining area that provides for the required buffer distances to be achieved.

4.2 Transport Screening

With an increase in the rate of ROM coal production compared to the production achieved from the current open cut operations in the Project Area, the Project will require an increase in the frequency of deliveries of Class 5.1 materials. The delivery frequency of Class 1 materials will not change from the present delivery frequency for the existing approved Wambo, however, there will be an increase in the delivery quantity. **Table 4.2** provides details of the anticipated traffic movements for Class 5.1 materials associated with the operation of the Project.

The estimated annual number of deliveries (650 deliveries per annum) of Class 5.1 materials exceeding 5 tonnes exceeds the SEPP 33 annual transport screening threshold trigger of 500 deliveries per annum. As a result, a transport route selection study has been prepared as part of this PHA for the delivery of Class 5.1 materials to the Project.

Table 4.2 Estimated Hazardous Material Deliveries

Material	ADG Class	No. of Deliveries for Existing Approved Wambo		Existing Approved Delivery Quantity Per Delivery (T)	No. of Deliveries with Project		Incremental Increase in Deliveries	Project Delivery Quantity Per Delivery (T)	Minimum Screening Threshold Quantity (T)	Deliveries Screening Threshold	
		Weekly	p.a.		Weekly	p.a.				Weekly	p.a.
Technical Grade Ammonium Nitrate	5.1	10	520	38	15	650	130	38	5	30	500
Ammonium Nitrate Emulsion	5.1	10	520	38	15	650	130	38	5	30	500
Detonators	1.1B	1	52	1	1	52	-	1.5	-	-	-
Boosters	1.1D	1	52	1	1	52	-	1.5	-	-	-

5.0 Hazardous Materials Storage Constraints

Where the SEPP 33 preliminary screening process identifies a development as being potentially hazardous, as is the case for this Project, *Multi-level Risk Assessment* (MLRA) (DoP 2011a) suggests the use of a preliminary analysis of the risks related to a proposed development to enable the selection of the most appropriate level of risk analysis in the PHA. This preliminary analysis includes risk classification and prioritisation using a technique adapted from the *Manual for Classification of Risk due to Major Accidents in Process and Related Industries (Manual for Classification of Risk)* (International Atomic Energy Agency – IAEA – 1993). A complete description of the technique is presented in the MLRA (DoP 2011a). The technique is based on a general assessment of the consequences and likelihoods of accidents, their risks to individuals and society, and the comparison of these risks to relevant criteria to determine the level of assessment required, be it qualitative or quantitative.

The preliminary screening of the hazardous materials inventories presented in **Table 4.1** indicates the Project may be potentially hazardous with respect to the storage of Class 5.1 materials and potential location of Class 1.1 materials, thereby triggering the PHA requirements in SEPP33. As discussed in **Section 4.1**, the storage facilities could potentially be relocated a number of times of the life of the Project to a suitable location within the Project mining area. As the exact relocation will be determined based on the needs of the mining operation at that time, the risk classification technique applied has been to identify the required minimum buffer distances between the Class 5.1 stores and land ownership boundary / public access area (e.g. Golden Highway) to ensure the risks posed to the surrounding land users are tolerable. The minimum buffer distance for the Class 1 store has been set at 320 meters based on the SEPP 33 preliminary screening process.

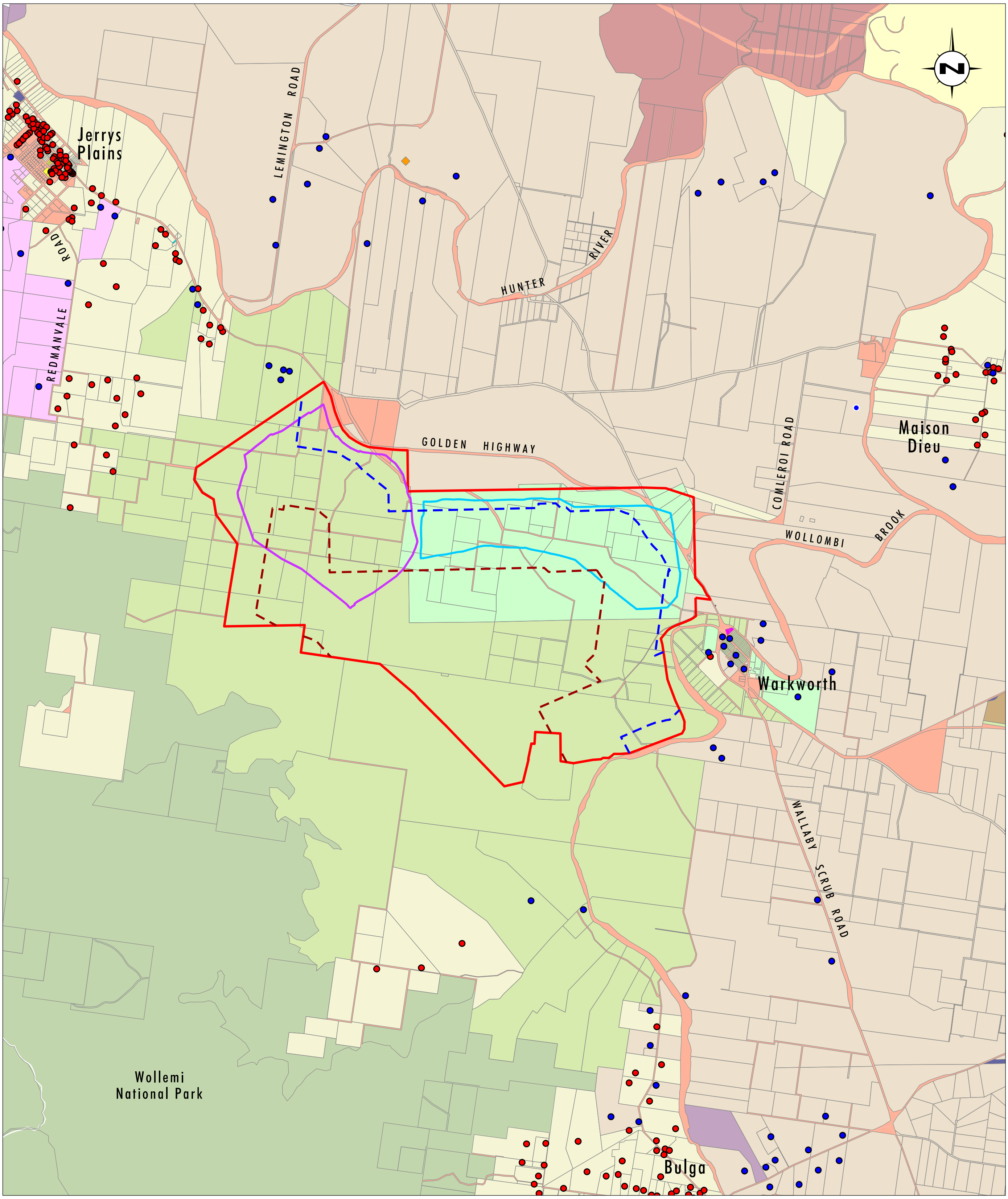
In relation to determining the appropriate buffer distances for Class 5.1 materials, the two primary hazards associated with Ammonium Nitrate Emulsion (ANE) and Technical Grade Ammonium Nitrate (TGAN are explosion and nitrogen dioxide generation. While ANE's primary classification is not as an explosive, under certain conditions it may be detonated. Using the Queensland Department of Natural Resources and Mines "Storage requirements for security sensitive ammonium nitrate (SSAN) - *Explosives information bulletin no. 53 ver 3*" (2008) as a guide to the effect of explosion overpressure, the safe distance from an explosion of a maximum storage quantity of TGAN (400 tonnes), is 900 metres. However, the consideration of gas release is also required to establish the required buffer distance.

Upon exposure to excessive heat ANE and TGAN can generate toxic nitrogen dioxide gas. For the purpose of this assessment, the maximum storage quantity of TGAN (400 tonnes) has been considered for the worst case toxic release scenario. Upon exposure to excessive heat, approximately 15% of the molecular nitrogen in TGAN is converted to nitrogen dioxide (Atkinson and Adams, 2002). Based on a 15% conversion rate, the yield of nitrogen dioxide from 400 tonnes of TGAN would be approximately 70 tonnes. Therefore the potential impacts associated with nitrogen dioxide generation from excessive heating or a fire involving TGAN has been based on 70 tonnes of a very high toxicity gas. This approach should be viewed only as a guide as to whether further assessment should be undertaken to consider credible toxic release scenarios.

For a very high toxicity gas storage of between 50 and 200 tonnes the risk classification technique undertaken in accordance with MLRA (DoP 2011a) indicates an effect distance of between 1000 and 3000 meters (refer to MLRA (DoP 2011a)). Assuming a linear increase in effect distance with toxic gas tonnage the maximum effect distance has been conservatively estimated to be 1,300 meters. Therefore the TGAN storage facilities should be located at least 1,300 meters from the land ownership boundary to ensure the off-site risk is tolerable.

Based on the above analysis, the consequence contours associated with an explosion of ANE or TGAN are much smaller than those associated with a toxic release resulting from the heating of ANE or TGAN. Therefore the separation distance from off-site land users associated with the storage of ANE and TGAN will be governed by the toxic release scenario.

Figure 5.1 shows the areas within the land ownership boundary that the Class 5.1 and Class 1.1 materials, at currently approved maximum storage quantity, may be stored based on the necessary buffer distances required to ensure the off-site risk is tolerable in accordance with relevant hazard assessment guidelines. The buffer distance required to the land ownership boundary / public access area (e.g. Golden Highway) for the storage of Class 5.1 and Class 1.1 materials is 1,300 meters and 320 meters respectively. These buffer distances may be reduced if maximum storage inventories for the Project are also reduced.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Area Offset 320m from Off-site Land Users (Class 1.1 Materials)
- Area Offset 1300m from Off-site Land Users (Class 5.1 Materials)
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Wanaruah Local Aboriginal Land Council
- Private Residence
- Mine Owned Residence

FIGURE 5.1

Areas Suitable for Hazardous Materials Storage

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6.0 Transport Route Evaluation

The estimated annual number of deliveries (650 deliveries per annum) of Class 5.1 materials exceeding 5 tonnes was found to exceed the SEPP 33 annual transport screening threshold of 500 transport movements, triggering the requirement for a transport route selection study. The following route selection study has been undertaken in general accordance with Hazardous Industry Planning Advisory Paper 11 *Route Selection*. The purpose of the route selection study is a relative ranking of each routing alternative rather than comparison with a given risk criteria.

6.1 Methodology

The methodology used to evaluate the relative levels of risk for alternate transport routes included the following steps:

- measure the frontage of each land use type (residential, rural, sensitive, industrial, commercial, active open space) along each route
- allocate a population density to each land use type
- estimate the fatality consequence effect area for the credible hazardous event
- estimate the frequency of the credible hazardous event occurring, and
- estimate the risk of fatality along the route in accordance with relevant guidelines using the above data.

Based on a review of historical hazardous events involving the transport of ammonium nitrate the credible hazardous event considered for the route evaluation was a TGAN explosion initiated by a truck fire. An explosion frequency during transit of 2 x 10^{-9} per year on rural roads was used in the risk estimation calculations. This frequency is that given by the UK Health and Safety Executive for explosion events involving the road transport of Class 1 materials. Due to the lower speeds on roads in built up areas and the presence of dual lane divided carriage ways, the explosion frequency used for residential and commercial land use was reduced by a factor of 10 to 2 x 10^{-10} per year. This is consistent with the findings in the Transport for NSW (TfNSW) report on *Heavy Truck Fatal Crash Trends and Single Vehicle Heavy Truck Crash Characteristics* (TfNSW, 2014), where the frequency of fatal accidents per kilometre travelled on rural roads is approximately 10 times the frequency of fatal accidents per kilometre travelled on metropolitan roads.

It was assumed that a full 38 tonnes of TGAN on a B-double truck would be involved in an explosion and the overpressures were estimated based on the SAFEX International *Good Practice Guide: Storage of Solid Technical Grade Ammonium Nitrate* (March 2011). Fatality likelihood at varying distance from the explosion was estimated based on the predicted explosion overpressures and a Probit relationship. The Probit relationship estimates the likelihood of a fatality resulting should an individual from the general population be exposed to a given overpressure level. **Table 6.1** presents the population densities used in the route evaluation.

Table 6.1 Land Use Population Densities

Land Use	Population Density (persons/hectare)
Residential	40
Rural	1
Sensitive (aged care)	40
Industrial	5
Commercial	160
Active Open Space	10

Fire initiated road transport explosions involving TGAN do not occur immediately after the initiating fire. Investigations of explosion events demonstrate that there is typically a delay of 30 minutes prior to detonation giving the nearby population time to evacuate the scene (Shah and Chys, 2006). Hsu and Peeta, (2013) note that for no-notice disasters, individuals need to respond to the changing disaster situations very quickly under a higher level of time pressure while Lindell and Hwang (2008) note that emotion-focused coping strategies, including threat denial, wishful thinking, and fatalism, can impede the adoption of hazard adjustment strategies. Jianwen and Wenxing (2011) report a wide range of compliance when responding to a recommendation to evacuate. With supportive media and direct exposure evacuation rates of up to 90% can be anticipated. Where there is a lack of supportive information and sceptical response reduction in the evacuation rates are likely. Based on the anticipated evacuation response associated with each land use category, the evacuation percentages in **Table 6.2** have been applied to the risk calculations.

Table 6.2 Percentage Evacuation

Land Use	Percentage Evacuation
Residential	90%
Rural	90%
Sensitive (aged care)	90%
Industrial	90%
Commercial	50%
Active Open Space	50%

6.2 Results

For assessment purposes, the transport of solid TGAN was assessed as being transported to the Project from a facility located on Greenleaf Road, Kooragang Island NSW (as per the current supply arrangement for Wambo). The route evaluation assessment for the transport of TGAN to the Project has considered the two alternate routes presented in **Table 6.3**. ANE may be delivered from a range of alternate locations. Two alternate routes were considered for the transport of ANE to the Project locations (selected for assessment purposes only considering current supply locations). The supply locations assessed were Mount Thorley and Liddell. The transport routes from each of the suppliers are presented in **Table 6.4**.

Table 6.3 TGAN Transport Routes Adopted for Assessment Purposes

Route 1	Route 2
• Greenleaf Road • Teal Street • Cormorant Road • Tourle Street • Industrial Highway • Pacific Highway • Wallsend Road • Sandgate Road • Newcastle Inner City Bypass • Newcastle Road • Thomas Street • Newcastle Link Road • Hunter Expressway • New England Highway • Golden Highway • Putty Road • Golden Highway	• Greenleaf Road • Teal Street • Cormorant Road • Tourle Street • Industrial Highway • Pacific Highway • New England Highway • John Renshaw Drive • Hunter Expressway • New England Highway • Golden Highway • Putty Road • Golden Highway

Table 6.4 ANE Transport Routes Adopted for Assessment Purposes

Supplier located at Mount Thorley	Supplier located at Liddell
• Melva Place • Maskey Road • Whybrow Road • Pearcefield Road • Mount Thorley Road • Golden Highway	• Pikes Gully Road • New England Highway • Lemington Road • Golden Highway

The transport route annual fatality risks estimated using the methodology outlined in **Section 6.1** for TGAN transport and ANE transport are presented in **Tables 6.5** and **6.6** respectively.

Table 6.5 TGAN Transport Risk

Land Use	Route 1 Risk (fatalities/year)	Route 2 Risk (fatalities/year)
Residential	5.73×10^{-6}	2.52×10^{-6}
Rural	4.47×10^{-6}	4.60×10^{-6}
Sensitive	-	2.29×10^{-6}
Industrial	11.5×10^{-6}	16.6×10^{-6}
Commercial	4.84×10^{-6}	4.58×10^{-6}
Active Open Space	2.47×10^{-6}	3.98×10^{-6}
TOTAL	**31.47×10^{-6}**	**34.59×10^{-6}**

The results indicate that the lowest risk transport route for TGAN from Kooragang Island to the Project is Route 1. However, the estimated levels of risk are very similar and the standard margin of error in estimated land use population densities and evacuation rates determined following the process in the advisory paper would likely account for the small difference in risk level. Therefore the difference in risk associated TGAN transport on either route may be considered insignificant.

Table 6.6 ANE Transport Risk

Land Use	Supplier located at Mount Thorley (fatalities/year)	Supplier located at Liddell (fatalities/year)
Residential	-	-
Rural	0.87×10^{-6}	1.86×10^{-6}
Sensitive	-	-
Industrial	10.1×10^{-6}	1.63×10^{-5}
Commercial	-	-
Active Open Space	-	-
TOTAL	**13.20×10^{-6}**	**18.19×10^{-6}**

Taking into account the exposure to different land use types, population densities, the likelihood of incidents for different road types and evacuation rates the route selection study indicated that the alternate routes for ANE transport posed approximately the same level of risk to the public. The levels of risk for transport of ANE from other supply locations are likely to be of a similar magnitude to the risk of transport from Mount Thorley and Liddell.

It is noted that the Project will not have direct control over the delivery of hazardous materials to the mining operations as it will be undertaken by a supply contractor. To assist in mitigating transport risk, the Project will select hazardous materials supply contractors that are approved carriers of dangerous goods and have suitable safety management systems to ensure the safe transport of hazardous materials.

7.0 Risk Management

The control of risks is a continuous process where strategies are put into place to eliminate risks wherever possible, mitigate the residual risks identified using appropriate control measures, safeguards and procedures, and, lastly, accept the residual risk and manage the impacts should the hazardous event occur. The risk control strategies and their effectiveness are broadly described as:

- engineering control to either completely eliminate the risk or to implement physical controls and safeguards
- administrative control based around procedures
- personnel control using training and the control of work methods.

A range of technical control measures and non-technical safeguards and procedures will be put in place in accordance with relevant Australian Standards and WorkCover requirements in order to eliminate or mitigate the level of risk associated with the operation of the facility.

Technical safeguards are those controls that are incorporated into the process or control system hardware, software or firmware. Non-technical controls are management and operational controls, such as security policies, operational procedures, maintenance procedures and training. Technical and non-technical safeguards can also be divided into preventive controls which inhibit or prevent hazardous events from occurring and detective controls such as control system alarms that warn of unacceptable process deviations, or security monitoring systems that initiate an alarm in the event of violations of security protocols.

The technical control measures that will be implemented as part of the Project include:

- locate the Class 5.1 explosives and Class 1.1 storages in accordance with the buffer distances specified in **Section 5.0**
- design of diesel tanks and refuelling systems in accordance relevant standards and codes
- design of hazardous materials storage area surface drainage systems to prevent spills or runoff from storage areas entering surrounding land/waterways
- storage of dangerous goods in dangerous goods compliant stores (in accordance with relevant Australian Standards) and appropriate segregation of incompatible dangerous goods.

The non-technical safeguards and procedures identified include:

- preparation of emergency response plans and security plans in consideration of location of storages
- implement appropriate housekeeping to minimise combustible materials within 30 metres of Class 5.1 and Class 1.1 storages
- on site speed limits and designated traffic flow directions to consider storage locations
- all equipment/vehicles associated with the handling of Class 5.1 and Class 1.1 materials are to be regularly inspected and maintained fit for duty in accordance with relevant standards

- all personnel involved in the handling and storage of Class 5.1 and Class 1.1 materials are to be appropriately trained and licenced
- ongoing implementation of appropriate hot work/safe work procedures for works in the vicinity of hazardous materials
- requiring hazardous material delivery contractors to put in place appropriate measures to minimise transport risks, including risk mitigation measures and route selection considerations, as part of the procurement process for hazardous materials.

8.0 Conclusions

The Project has been identified as being potentially hazardous with respect to the storage of both Class 5.1 and Class 1.1 dangerous goods. This is due to the expected *relocation* of the existing storage facilities and not due to any proposed material change to current work practices as a result of the Project. Should the storage facilities remain in their present location, the present level of risk to off-site land users will remain unchanged from the existing approved Wambo mine. Should the storage facilities be relocated, the risks to off-site land users will be tolerable provided that the storages are located within the areas specified in **Section 5.0**. United has committed to implementing the appropriate buffer zones specified in **Section 5.0**.

The transport of Class 5.1 materials to the Project was found to trigger SEPP 33 screening thresholds requiring a route selection study to be undertaken. Relative risks for two alternate routes for the transport of TGAN from Kooragang Island to the Project were estimated. Relative risks for the transport of ANE from two alternate suppliers to the Project were estimated.

The Route Selection study indicates that the levels of risk associated with the TGAN transport along both Route 1 via the Inner City Bypass and Route 2 via John Renshaw drive are approximately equal. The Route Selection Study also found that transport of ANE to from the two representative assessment locations are approximately equal.

The Project will not have direct control over the delivery of hazardous materials to the mining operations as it will be undertaken by a supply contractor. To assist in mitigating transport risk, the Project will select hazardous materials supply contractors that are approved carriers of dangerous goods and have suitable safety management systems to ensure the safe transport of hazardous materials.

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