REPORT

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Technical Assessment of Hazardous Substances

Willows Road site and the Wharekirauponga Underground Mine - Waihi North Project

Prepared for

Oceana Gold (New Zealand) Limited

Prepared by

Tonkin & Taylor Ltd

Date

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Executive summary

Oceana Gold (New Zealand) Limited (OGNZL) is seeking resource consent via the Fast-track Approvals process to establish a new mining operation in the Wharekirauponga Valley. This new mine, referred to as the 'Wharekirauponga Underground Mine' (WUG), is part of the Waihi North Project (WNP) to extend the life of mining activities in Waihi. The WUG is located approximately 10 km north of the township of Waihi. The resource lies beneath the Coromandel Forest Park administered by the Department of Conservation (DOC) and within the Wharekirauponga Minerals Mining Permit (60541) area.

Oceana Gold has prepared this Fast-track application seeking approvals for the WNP under the Resource Management Acti 1991 (RMA), Conservation Act, Crown Minerals Act 1991, and Wildlife Act 1953.

This hazardous substances technical assessment has been prepared to evaluate the effect of hazardous substance storage and use associated with the establishment of the WUG and the mine access tunnel, which has a portal entrance on land owned by OGNZL on Willows Farm, Waihi. Hazardous substances will be both stored and used on the surface at Willows Road and underground within the tunnel and mine, which extends beneath the Coromandel Forest Park.

The activity will include the storage and use of explosives, oxidising and toxic substances, workshop gases, fuels, maintenance oils and greases at the surface and within the underground mine.

The storage and use of hazardous substances in New Zealand is governed primarily by the Health and Safety at Work (Hazardous Substance) Regulations 2017, which sets out control measures triggered by the volumes and types of hazardous substances proposed. Hazardous substance storage and use is further controlled by Resource Management Act 1991, exercised through Chapter 7.7. of the Hauraki District Plan (HDP). The proposed activity requires resource consent in accordance with the HDP Rule 7.7.10 as a non-complying activity for use of hazardous substances in the Conservation (Indigenous Forest) Zone at the WUG mine.

This assessment has evaluated the hazards and risks in accordance with the Ministry for the Environment Guidance for Hazardous Facilities (2000), with supplementary guidance from the New South Wales Department of Planning's Hazardous Industry Planning Advisory Paper series.

The key risks identified for the Willows Road tunnel portal site and WUG mine include:

- Risk to people or property from fire or detonation at the explosives magazines, oxidiser storage area or diesel tanks;
- Risk to ecosystems from a spill of diesel during tank filling or equipment refuelling; and
- Risk to ecosystems from a spill of packaged goods during unloading to site or movement to the dedicated stores in the underground mine.

The risks to people, property and the environment from an unintended detonation at the proposed explosives storage locations is assessed as low and will be managed through site and equipment design (e.g. separation distances to off-site locations and other explosives stores, provision of fire protection systems and certification of the explosives storage magazines) and management controls (personnel access restrictions, security monitoring, staff training and handler certification, and emergency response plans).

The surrounding areas at the surface at Willows Road and in the Coromandel Forest Park above the WUG are considered sensitive to the effects of an unintended detonation. However, taking into account the proposed controls and distance to sensitive land uses, the effects on off-site people and property from the proposed hazardous substances storage has been assessed as less than minor.

Similarly, the impact of a detonation of the Class 1 explosives in the WUG has potential to impact people in the Coromandel Forest Park in the vicinity of the mine ventilation stacks. A quantitative assessment of the effect using dispersion modelling was undertaken in an Air Quality Assessment, which found that even with a number of conservative inputs, criteria for the protection of human health is met at all locations around the surface connections.

The risks to people, property and the environment from a fire at the surface facilities area of the Willows Road portal entrance site is low and managed through site and equipment design (e.g. separation of incompatible substances, combustible material and ignition sources and provision of fire fighting facilities) staff training, and emergency response plans. The proposed hazardous substances storage locations are isolated from public access.

The environment is considered sensitive to the effects of a spill of diesel or packaged goods. The risk to the environment will be managed through the site design (e.g. proposed spill containment measures including double skinned tanks, sealed refuelling areas, bunded storage areas and provision of water treatment for run-off arising from areas where these substances are stored or used) and operational procedures (e.g. spill response plan, unloading and safe handling procedures). Taking into account these controls, the effects on the environment from the use and storage of hazardous substances have been assessed as less than minor and consistent with the HDP objectives and policies for hazardous substances.

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1 Introduction

1.1 Background and revisions for fast-track application

OceanaGold (New Zealand) Ltd (OGNZL) is seeking resource consents via the newly passed Fast-track Act to establish a new mining operation known as the 'Wharekirauponga Underground Mine' (WUG) as part of the Waihi North Project (WNP). The WUG is located approximately 10 km north of the township of Waihi. The resource lies beneath the Coromandel Forest Part administered by the Department of Conservation (DOC) and within the Wharekirauponga Minerals Mining Permit (60541) area.

OGNZL has prepared a Fast-track application seeking all approvals necessary for the WNP under the RMA, Crown Minerals Act 1991, Wildlife Act 1953, Conservation Act 1987 and Reserves Act 1977.

A staged approach is proposed as follows:

- **Stage One:** Support Wharekirauponga underground (WUG) mine resource investigation and exploration progression, establish access tunnels and surface facilities at Willows Road site.
- **Stage Two:** ongoing mining and production activities of the WNP
- **Stage Three:** two years of remediation and closure activities.

The activities at the Willows Road and WUG sites assessed in this report will span Stages One and Two. In Stage One, further geotechnical and hydrogeological drilling and testing within the Coromandel Forest Park is proposed to identify suitable locations for the mine ventilation shafts. At the time of writing, the general area that these will be located in is known, but not the precise coordinates of each vent. The impact assessments (for overpressure and discharges to air) are considered representative of the degree of impact from any location within the proposed WUG area. It is not anticipated that the effects will vary significantly from those assessed.

Tonkin & Taylor Ltd (T+T) has been engaged by OceanaGold to prepare this hazardous substances assessment to support its resource consent application for the Waihi North Project.

1.2 Waihi North Project overview

The WNP includes activities and infrastructure changes to extend the mining activities within the Waihi area summarised in **Table 1.1**. The area locations are shown on **Figure 1.1.**

This assessment report relates to the proposed development within Areas 1 and 2 to establish surface facilities and the tunnel portal at Willows Road, to construct and maintain the WUG Dual tunnel and to establish and operate the WUG mine.

Table 1.1: WNP area overview

Area	Purpose / activity	Detail
Area 1	Exploratory activities (drilling, camps) and WUG resource, WUG Dual Tunnel and supporting infrastructure	The key features of the WNP within project Area 1 include: • Activities associated with mine resource investigation, exploration and environmental monitoring within the Coromandel Forest Park; • Terrestrial and riparian restoration and enhancement planting where it is necessary to rehabilitate sites used for mine resource investigation and exploration; • The construction and maintenance of the WUG Dual Tunnel; • The establishment and operation of the WUG including the construction of four ventilation raises; • Ecological mitigation and enhancement activities designed to manage potential effects on terrestrial ecology and to improve populations of native frogs on public conservation land; • The undertaking of works in areas with recognised heritage and / or archaeological values; and • Closure and remediation activities at the completion of the mining of the WUG.
Area 2	Willows SFA, Willows Access Tunnel and supporting infrastructure	The key features of the WNP within project Area 2 will include: • The Willows SFA; • The Willows Portal and Willows Access Tunnel; • Terrestrial and riparian restoration and enhancement planting; • The salvage and translocation of freshwater fish, kōura and mussels; • The undertaking of works in areas with recognised heritage and / or archaeological values; • Closure and remediation activities at the completion of the mining of the WUG.
Area 3	Tunnel connection to OGNZL facilities in Waihi – Wharekirauponga Access Tunnel	The key features of the WNP within project Area 3 will include: • The Wharekirauponga Access Tunnel; and • Terrestrial and riparian restoration and enhancement planting; and • Closure and remediation activities at the completion of the mining of the WUG.
Area 4	Services trench from Willows Road site to OGNZL Waihi site	The key features of the WNP within project Area 4 will include: • The Services Trench; • Terrestrial and riparian restoration and enhancement planting. and • The undertaking of works in areas with recognised heritage and / or archaeological values.

Area	Purpose / activity	Detail
Area 5	OGNZL facilities in Waihi, including Processing Plant, Water Treatment Plant and Gladstone Open Pit (GOP) and GOP Tailings Storage Facility (GOP TSF)	The key features of the WNP within project Area 5 will include: • The GOP and subsequent GOP TSF; • The WUG Portal, Gladstone Portal, and potential Martha Underground Mine ("MUG") Portal; • Upgrades to the existing Processing Plant; • Upgrades to the existing WTP; • Terrestrial and riparian restoration and enhancement planting; • The undertaking of works in areas with recognised heritage and / or archaeological values; and • Closure and remediation activities at the completion of the mining of the WUG.
Area 6	Existing Waste Disposal Area. New activities at this location include the Northern Rock Stack and borrow pits and storage of Class 1 explosives	The key features of the WNP within project Area 6 will include: • The NRS and an adjoining borrow area; • Terrestrial and riparian restoration and enhancement planting; • The salvage and translocation of freshwater fish, kōura and mussels; • The undertaking of works in areas with recognised heritage and / or archaeological values; and • Closure and remediation activities at the completion of the mining of the WUG.
Area 7	Development and operation of TSF3 and borrow pits	The key features of the WNP within project Area 7 will include: • TSF3 and adjoining borrow areas; • Terrestrial and riparian restoration and enhancement planting; • The salvage and translocation of freshwater fish, kōura and mussels; • The undertaking of works in areas with recognised heritage and / or archaeological values; and • Closure and remediation activities at the completion of the mining of the WUG.

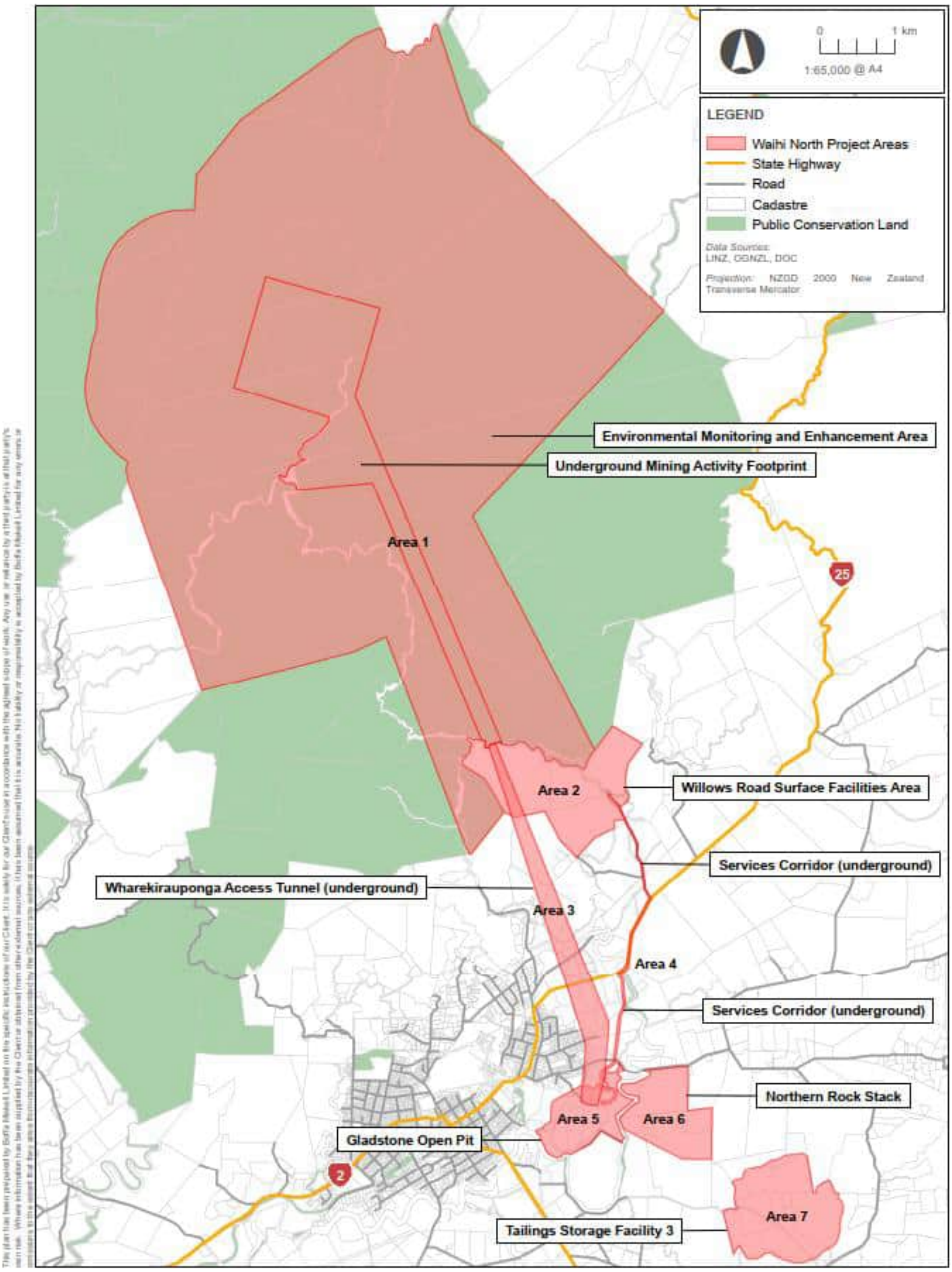

Figure 1.1: Area plan for the WNP
Source: Boffa Miskell Ltd, BM210482_AEE_01_A4P_B1_Overview, Feb 2025

1.3 Assessment scope

The proposed WUG is located approximately 10 km north of the township of Waihi. The resource lies beneath the Coromandel Forest Part administered by the Department of Conservation (DOC) and within the Wharekirauponga Minerals Mining Permit (60541) area.

The proposal includes the storage and use of hazardous substances to service the establishment and operation of the mine with a portal entrance on land owned by OGNZL at Willows Road, Waihi. The portal entrance site will include surface storage of six high explosives (H.E) magazines, one initiating explosives (I.E) magazine, a store for oxidising substances and storage of fuels, workshop gases and oils for servicing equipment.

Once access to the ore body has been established it is expected that underground facilities will be established for the substances regularly used at the mining face. This will include establishment of six H.E and I.E. storage chambers, two compounds for storage of oxidising substances, one for gasser (a low toxicity substance for use with the oxidisers) and up to two small portable diesel tanks within the mine extending beneath the Coromandel Forest Park.

The storage and use of hazardous substances is governed primarily by the Health and Safety at Work (Hazardous Substance) Regulations 2017 and further controlled by Resource Management Act 1991 via the Hauraki District Plan (HDP). The proposed use and storage of hazardous substances in the quantities proposed requires resource consent in accordance with the HDP.

Any new storage and use of hazardous substances under Rule 7.7.12(5) requires the use of the Hazardous Facility Screening Procedure (HFSP) to calculate an effects ratio for the activity, which can be compared to the permitted and restricted discretionary effects ratio thresholds set for each zone. However, there are no effects ratios provided for activities in the Conservation (Indigenous Forest) Zone, and as such the storage of substances in the mine is a non-complying activity under Rule 7.7.10 of the HDP.

1.4 Assessment approach and background documents

This hazardous substances assessment has been prepared to support an application for land use consent under the Fast-track Approvals process in accordance with methodology typically used for applications under the Resource Management Act, for the proposed industrial activities on OGNZL's landholding at the Willows Road site and within the WUG. The assessment has been prepared following guidance contained in the listed reference documents below:

The approach to hazardous substances risk assessment in this report has been informed by the following sources, which are referenced where relevant:

- Assessment Guide for Hazardous Facilities, Ministry for the Environment, 2000
- Assessment Guideline, Multi-level Risk Assessment. State of New South Wales through the Department of Planning, 2011
- Land Use Planning Guide for Hazardous Facilities, Ministry for the Environment, 2002
- Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning. State of New South Wales through the Department of Planning, 2011
- Decision making: A technical guide to identifying, assessing and evaluating risks, costs and benefits, Environmental Risk Management Authority, 2009
- Risk Assessment Methodology for Hazardous Substances, Environmental Protection Authority, January 2020

This assessment report has been prepared to supplement the *Waihi North Project – Resource Consent Applications and Assessment of Environmental Effects* prepared by Mitchell Daysh Limited, dated.

The assessment of the impact of explosives has been informed by two assessments prepared by Global Seismic Solutions (GSS): the *Willows Road – Surface Magazine Location Assessment, Waihi North Project*, 20 October 2021 attached as Appendix A and the *Wharekirauponga Underground Mine (WUG) Class 1 Storage Assessment*, 10 December 2021 attached as **Appendix B**. The GSS reports identify the following supplementary guidance which informed the design of the facilities and quantification of impacts from Class 1 explosives storage:

- AS 2187.1 Explosives—Storage, Transport and Use, Part 1: Storage
- International Ammunition Technical Guideline (IATG 2.20), Quantity and Separation Distances (United Nations - Safer Guard) (2nd Edition 01.02.2015)
- International Ammunition Technical Guideline (IATG 1.80), Formulae for Ammunition Management (United Nations - Safer Guard) (2nd Edition 01.02.2015).

In light of the new staged approach to mine development, further investigation is being undertaken to determine vent shaft locations with suitable geotechnical and hydrological conditions. The locations assessed by GSS are not expected to be the precise locations of the ventilation shafts. Further investigation is required in order to identify the final locations of up to two fresh air intakes and two exhaust vents. This is discussed further in Section 2.3 regarding the area in which the surface connections are proposed to be located and Section 6.3 in terms of the calculated overpressure levels.

1.5 Definitions

The following terms are used throughout the report and have distinct meanings as set out in the Ministry for the Environment's Assessment Guide for Hazardous Facilities (2000) or the Resource Management Act 1991 (RMA):

- **Hazard** – describes physical situations, process and/or actions that have the potential to exert adverse effects on people, ecosystems and/or the built environment.
- **Risk** – is the likelihood of specified consequences of a specific event (e.g., explosion) on people, ecosystems and/or the built environment. Therefore, the magnitude of risk is the product of probability and consequence (Risk = Probability × Consequences).
- **Effect** – means any impact or change as a result of an activity and, as defined by Section 3 of the RMA, can be positive or negative, temporary or permanent, applicable to the past, present or future, or cumulative with other effects.
- **On**-site – Refers to areas within OGNZL operational control
- **Off**-site – Refers to areas outside of OGNZL landholding or operational control

2 Sensitivity of local environment

2.1 Site location

Figure 2.1 shows an overview of some of the key elements of the WNP, from the tunnel portal to the WUG in the Coromandel Forest Park. The key supporting infrastructure is proposed to be located at the tunnel portal entrance site at Willows Road, Waihi and is referred to as the surface facilities area (SFA). At a later stage in the WUG development, some hazardous substances storage will be located underground within the WUG to facilitate the mining operations.

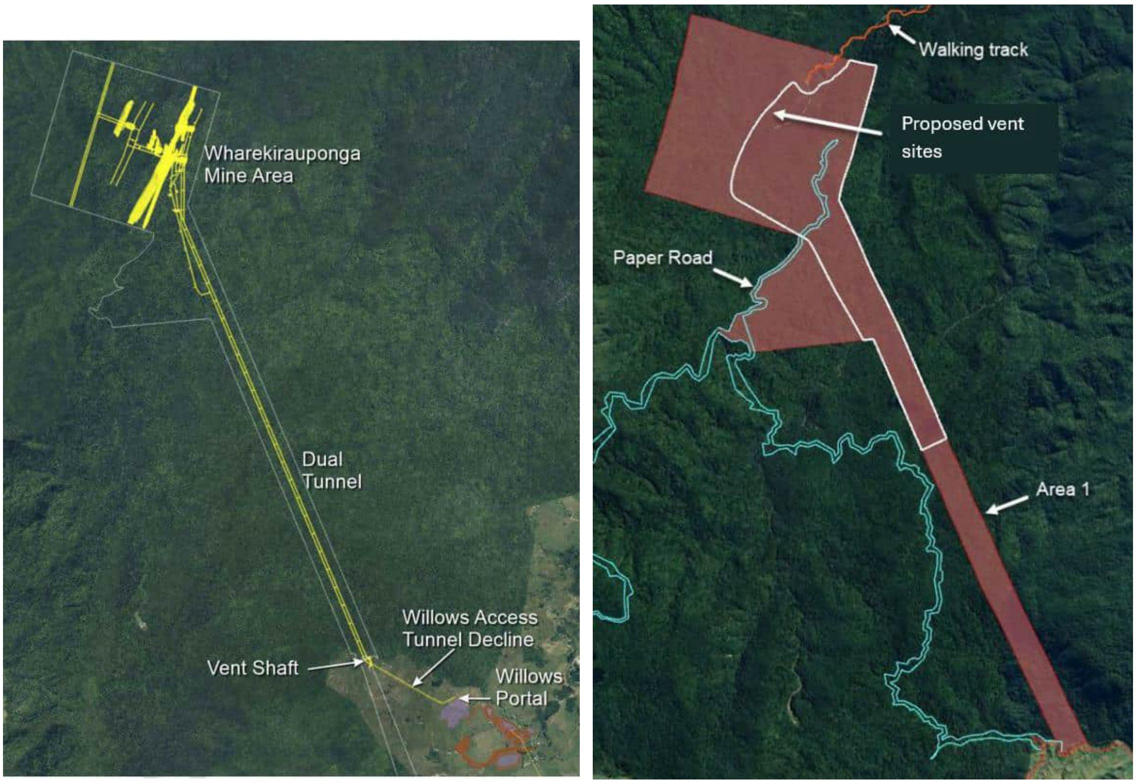

Figure 2.1: Overview of portal entry at Willows Road, tunnel pathway and WUG mine area (left) and indicative area for WUG surface vent connections shown in the white outline area (right) Source: OGNZL

2.2 Willows Road portal entrance site

The portal entry and areas of hazardous substance storage (the SFA and at the surface explosives magazine compound) are located entirely within land owned by OGNZL. This land is zoned Rural under the HDP. The tunnel itself extends to the Wharekirauponga ore body beneath the Conservation (Indigenous Forest) zone which is also scheduled as a Significant Natural Area (see **Figure 2.2**).

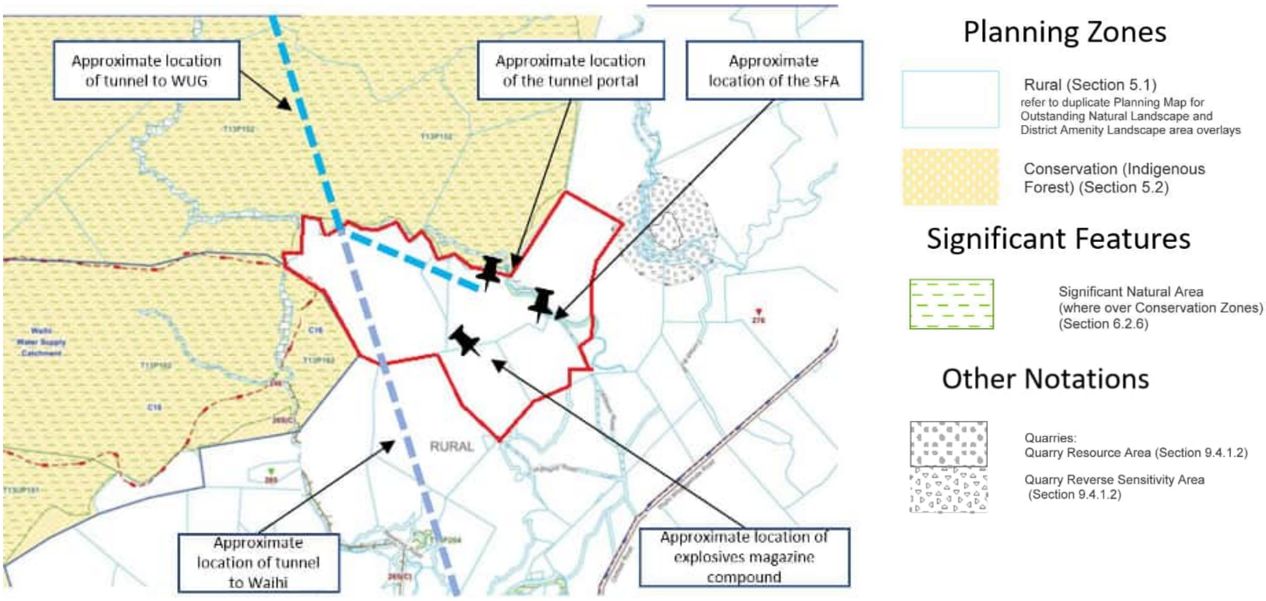

Figure 2.2: Surrounding land zoning of areas around the Willows Rd site (OGNZL owned land outlined in red) (map derived from: Hauraki-dc-govt.nz)

The nearest Residential Zone land is the township of Waihi approximately 2 km southwest of the portal entry. The closest dwellings are located in the Rural Zone to the south, approximately 595 m away from the explosive magazines, as shown in **Figure 2.3** below.

The Rural zoning of the land to the south provides a buffer of low-density land use between the Willows Rd site and the Waihi township residential areas. However, use of this land for rural residences and farming and the recreation opportunities provided by land to the north (Coromandel Forest Park) means the surrounding land uses are potentially sensitive to the effects associated with explosives storage at the proposed explosives magazines and the storage of oxidisers adjacent to the portal entry.

The Mataura Stream flows along the northern border of the site with the Coromandel Forest Park. It bisects the site north of the SFA and connects with the Ohinemuri River southeast of the site. The stream is sensitive to effects associated with spills of ecotoxic materials.

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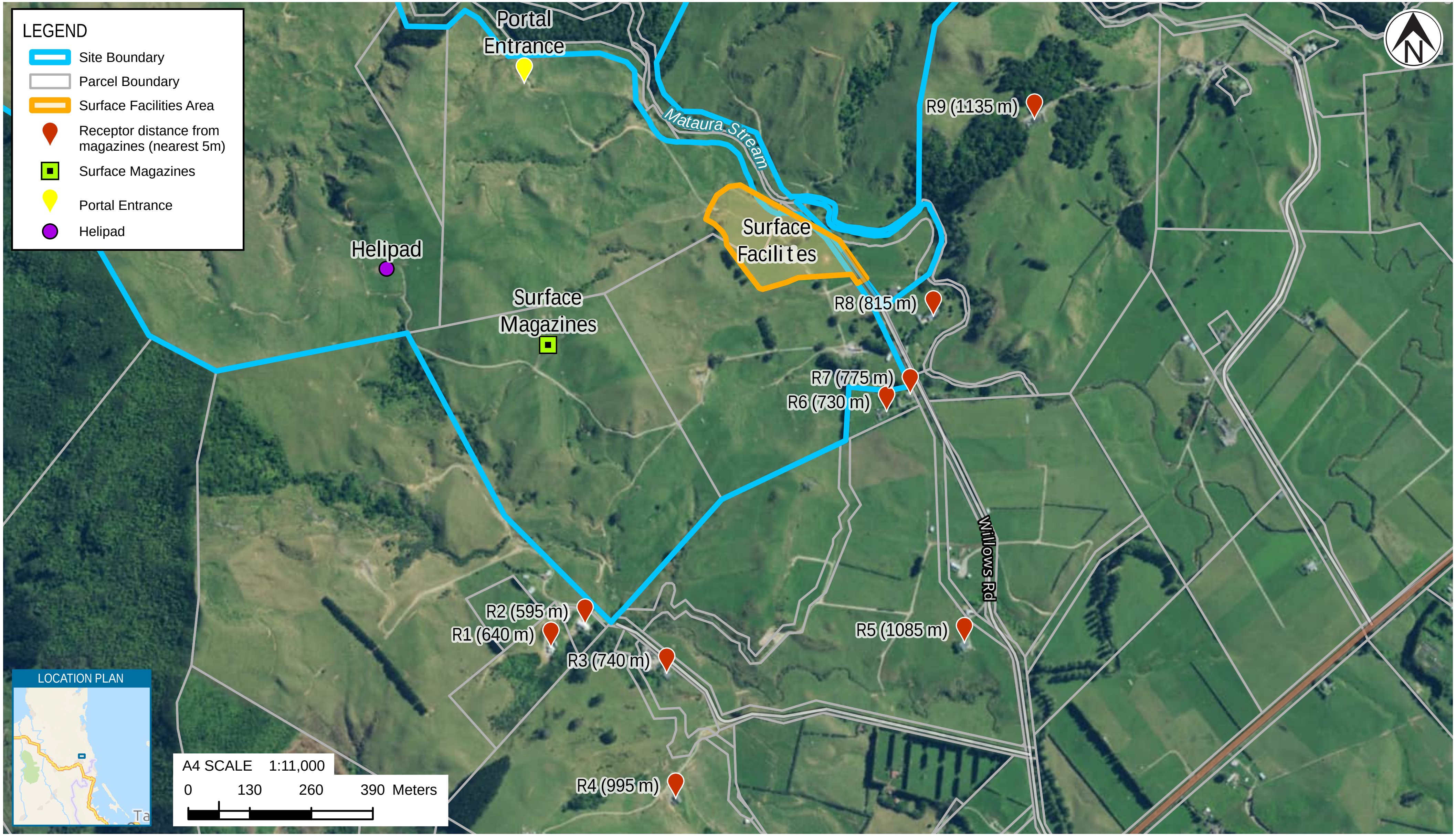

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CLIENT **OCEANA GOLD NEW ZEALAND LIMITED**
PROJECT **WAIHI NORTH PROJECT - WILLOWS ROAD SITE**
TITLE DISTANCES TO SENSITIVE RECEPTORS FROM SURFACE EXPLOSIVE MAGAZINES
SCALE (A4) 1:11,000 FIG No. FIGURE 2.3 REV 2

2.3 WUG

The WUG ore body is located beneath the Conservation (Indigenous Forest) Zone as shown on **Figure 2.4**. Due to the depth at which the Class 1 explosives facility is proposed to be located, the receiving environment relevant to the impacts to off-site people, property or the environment is considered to be in the vicinity of the surface connections.

Up to six surface connections are proposed to be established: two portals (one at the Waihi Processing Plant, one at the Willows Road site), one fresh air intake at the Willows Road site, two fresh air intakes over the WUG and two return air rises (exhaust vents) over the WUG.

An isometric view of the surface connection locations is also included as **Figure 2.5** below, two of which (the portal and one vent shaft) are on the Willows Road portal site described in Section 3.1.1 above.

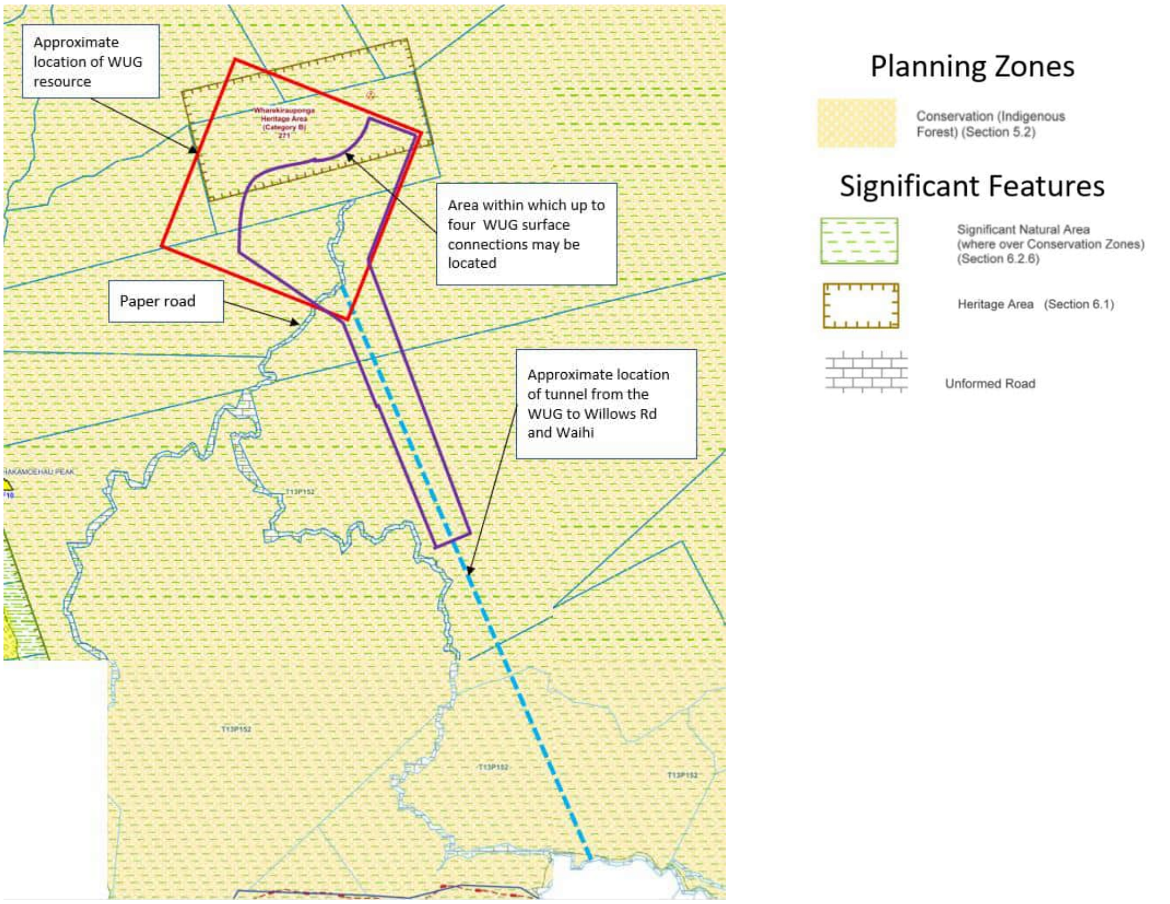

Figure 2.4: Surrounding land zoning of areas around the WUG mine, purple outline area showing indicative location of four surface connections (source: OGNZL)

In the event of an unintended detonation in the underground explosives storage facility, the overpressure would propagate through the mine space and be expelled at the surface connections, which include the access portal, fresh air intakes and return air rises. The indicative surface connection configuration is illustrated in **Figure 2.5** below. These locations are the key sites at which there is potential for effects on off-site people or property in the event of an unintended detonation at the storage facility.

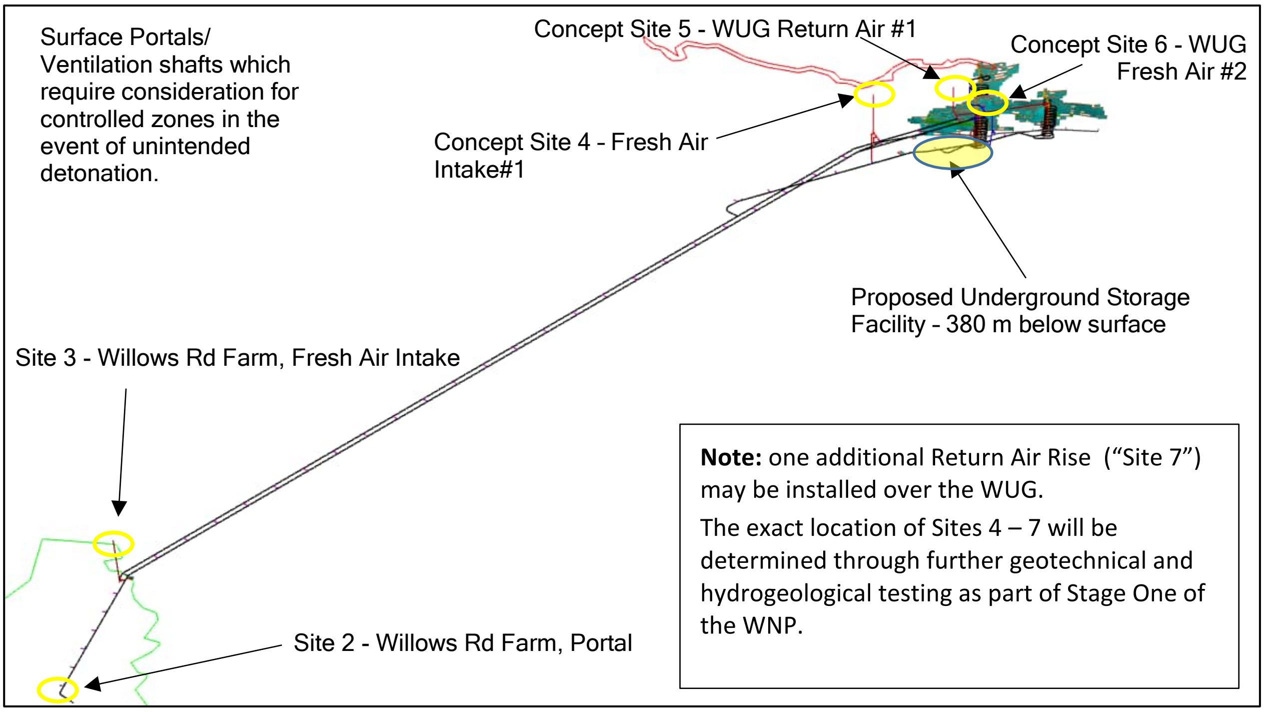

Figure 2.5: Underground storage facility location in relation to surface vents (source: GSS, 2021. Note: Site numbering has been adjusted for consistency with more recent reports)

The surface connection locations, zoning under the HDP and public accessibility are detailed in **Table 2.1** below.

Table 2.1: Description of surface connections (GSS, 2021)

Site ID[1]	Zone	Description	Proximity to WUG
Site 1 – Waihi Portal	Martha Mineral	The portal for receipt of the ore for processing at the nearby processing plant. This is within OGNZL's industrial site and is not accessible to the public.	Approximately 10 km southeast of the WUG.
Site 2 – Willows Portal	Rural	The main access portal to the mine consists of a large horizontal type decline that is used as the main entry/ exit route to the WUG.	Approximately 7 km southeast of the WUG.
Site 3 – Willows Rd Farm Fresh Air Intake	Rural	This fresh air intake connection is located within OGNZL owned land at the northern end of the Willows Road site.	Approximately 6 km from the WUG.
Site 4 – WUG Fresh Air #1	Conservation (Indigenous Forest)	The proposed each located within a remote forested area of the Coromandel Forest Park, accessible by the public. However, each proposed location will consist of a 10 m x 10 m area with a perimeter fence restricting access to members of the public. Two of the sites are expected to be fresh air intakes, and two will exhaust air from	Expected to be located within 3 km of the WUG.
Site 5 – WUG Return Air #1	Conservation (Indigenous Forest)		Assessed indicative locations were 0.6 km from the underground Class 1 explosives store at the closest point.
Site 6 – WUG Fresh Air #2	Conservation (Indigenous Forest)		

Site ID[1]	Zone	Description	Proximity to WUG
Site 7 – WUG Return Air #2 (NEW)	Conservation (Indigenous Forest)	the mine when the mine's ventilation system is operational.	

1. Site names updated for consistency with other reports.

Two of the connections (Sites 2 & 3) are on OGNZL owned land at Willows Road, and up to four are proposed to be located within the Coromandel Forest Park. While there is an old walkway along the paper road (shown south of the WUG on **Figure 2.4**), this is not maintained as a public walkway and therefore not used by members of the general public. There is also a walkway that terminates in a loop in the northern area of the surface above the WUG (shown on **Figure 2.1**), that may be used by members of the public[1].

The surface connections in the Coromandel Forest Park are air return vents or fresh air intakes, an example of which is included as **Figure 2.6** below. The location of each surface connection will be securely fenced off to exclude members of the public from close proximity to the area.

Figure 2.6: Typical return air rise vent *Source: OGNZL*

[1] At the time of reporting, public use of the walkway and the Wharekirauponga valley area more generally is excluded as a protective measure against kauri dieback. It is expected that public access could be reinstated in future,

3 Description of proposed activities and substances

3.1 Proposed activities involving hazardous substances

3.1.1 Willows Road portal site

The following activities at the Willows Road tunnel portal site (see **Figure 3.1**) will store and use hazardous substances:

- Storage of explosives at six H.E magazines and one I.E magazine located southwest of the portal. These explosives substances will be transported via an internal access road and the tunnel portal where they will be charged at the development face and within the underground mine;
- A store for ammonium nitrate emulsion and gasser will be established at the northern end of the SFA adjacent to the portal. These two substances will be transported via internal access road and used in tunnel development and underground mining;
- A covered, sealed service workshop in the SFA that will store gas cylinders (oxygen, acetylene) for welding/cutting and oils and greases for servicing of mechanical equipment;
- Diesel will be stored in above ground double skinned refuelling units at a services bay in the SFA;
- A smaller volume of diesel may also be stored in association with the fire protection system to power the water pumps and in a small tank to service the site emergency power generator;
- A helipad is proposed to be located approximately 400 m northwest of the surface explosives storage magazine, to be used for deliveries of personnel, equipment and materials. There will not be any associated storage or use of hazardous substances at the helipad.

Table 3.1 details the proposed quantities and locations of hazardous substances at the Willows Road site.

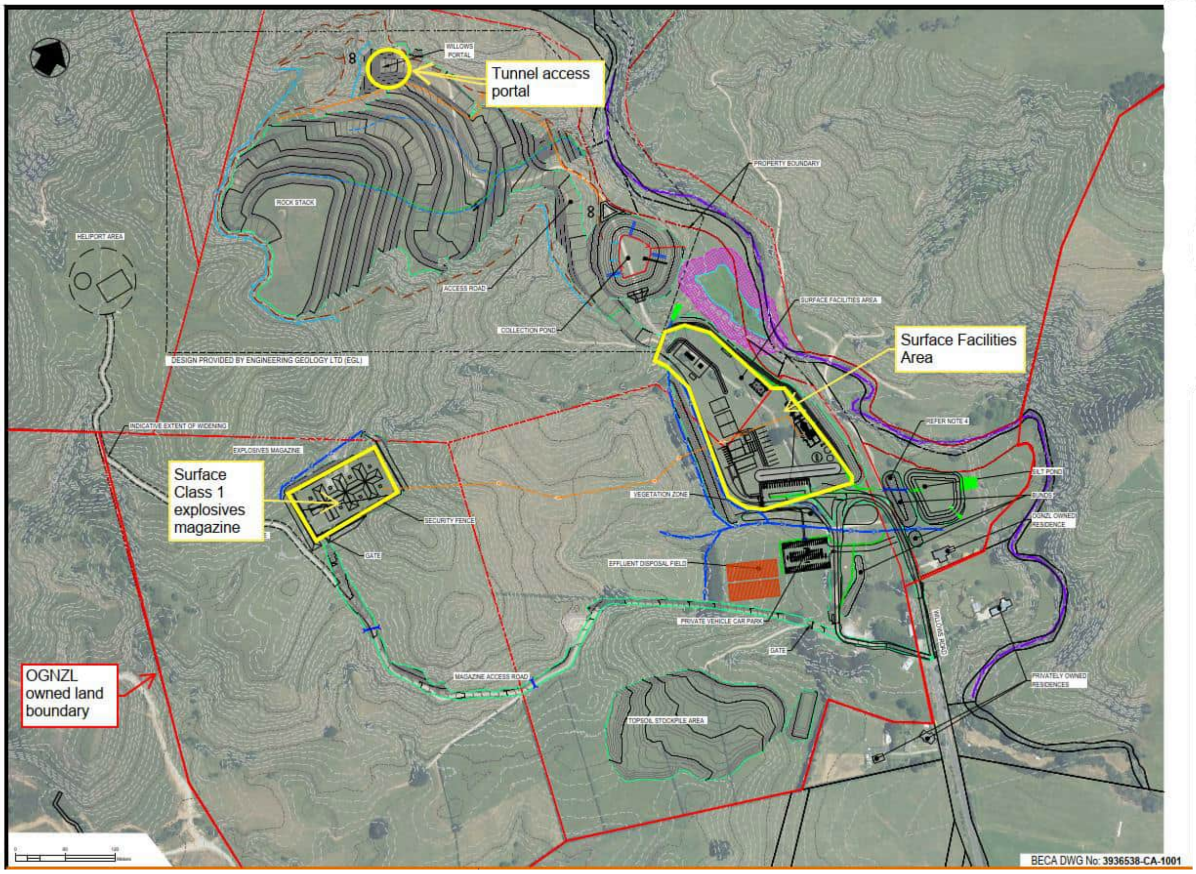

Figure 3.1: Layout of Willows Rd portal entrance site highlighting key areas
Source: BECA WAI-981-000-DWG-CI-1001 Rev O

Civil drawings showing details of the SFA layout are included in **Appendix C**.

3.1.2 WUG

At a later stage of WUG development, establishment of hazardous substances stores underground are proposed as follows:

- Storage of explosives in six separate H.E. chambers and one I.E. chamber;
- Storage of ammonium nitrate emulsion (ANE) and gasser, which are mixed in-situ to produce an explosive substance when packed into the blast hole; and
- Up to two small portable double skinned refuelling units containing diesel and packages of maintenance oils or greases.

Deliveries of these substances will be made at either the Willows Road or Waihi portal entrance sites and transported via tunnel to the underground storage locations indicated on **Figure 3.2**. The H.E. and I.E. chambers will be located at a depth of 380 m. Quantities of substances proposed to be stored underground are also included in **Table 3.1.**

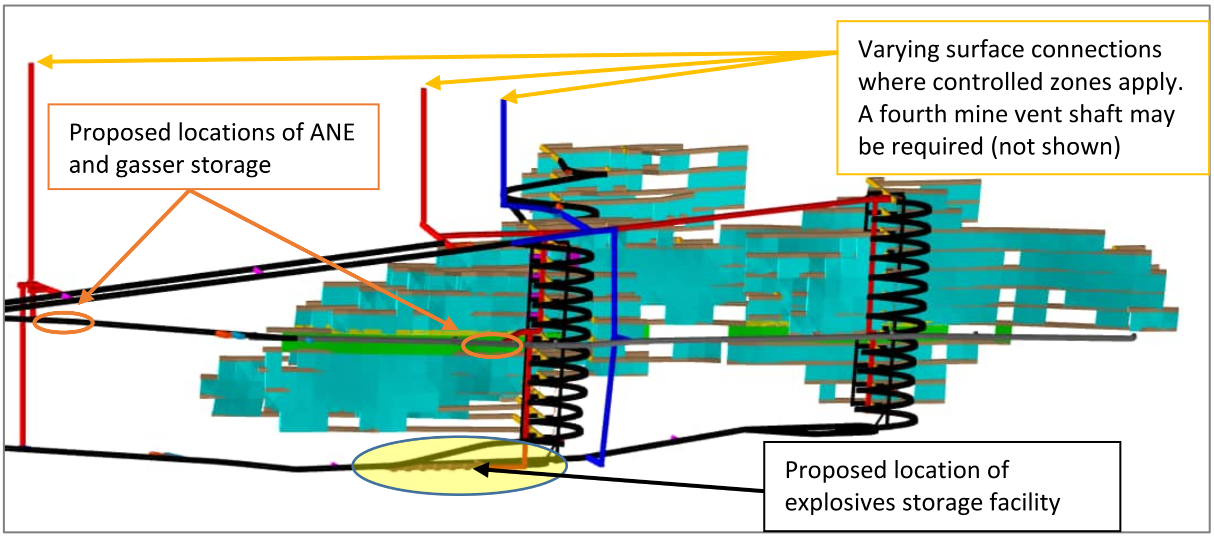

Figure 3.2: Underground mine layout showing the key hazardous substance storage locations. Section looks west. *Source: OGNZL 2022*

3.2 Hazardous substances classification and quantities

Classifications for hazardous substances are assigned under the Globally Harmonised System (seventh revised edition) (GHS7), which was adopted in New Zealand in 2021. Both the former classifications assigned under the Hazardous Substances and New Organisms Act 1996 (HSNO) from the safety data sheet and the equivalent GHS7 classification are presented in **Table 3.1** below, as the HSNO classifications are still commonly used and understood in New Zealand and referred to within the relevant health and safety regulations.

Table 3.1: Hazardous substance volumes and classifications

<table>
<tr><th rowspan="2">Substance</th><th rowspan="2">State of substance</th><th colspan="2">Hazard classification</th><th rowspan="2">Proposed maximum volume</th><th rowspan="2">Storage Location</th></tr>
<tr><th>HSNO</th><th>GHS7</th></tr>
<tr><td>ANFO
(UN 0082)</td><td>Solid</td><td>1.1D,

6.1D,
6.3B,
6.7B,
9.1D</td><td>1.1D - Substances and articles that have a mass explosion hazard
Acute toxicity Category 4 (oral route)
Eye irritation Category 2
Carcinogenicity Category 2
Hazardous to the aquatic environment chronic Category 4</td><td rowspan="3">7,350 kg NEQ

6,100 kg NEQ</td><td rowspan="3">SFA: Surface explosive magazines
(max 1,300 kg NEQ in any magazine)

WUG: Underground chambers (max 1,000 kg NEQ in any chamber)</td></tr>
<tr><td>Booster
(UN 0042)</td><td>Solid in card or plastic casing</td><td>1.1D,

6.1C,

6.9B,

9.1B</td><td>1.1D - Substances and articles that have a mass explosion hazard
Acute toxicity Category 3 (oral, dermal and inhalation route)
Specific target organ toxicity – single exposure Category 2
Hazardous to the aquatic environment chronic Category 2</td></tr>
<tr><td>Packaged explosive
(UN 0241)</td><td>Plastic encapsulated emulsion</td><td>1.1D,

6.1D,
6.3A,
6.4A,
6.8C,
6.9A,

9.1A,

9.3C</td><td>1.1D - Substances and articles that have a mass explosion hazard
Acute toxicity Category 4 (oral route)
Skin irritant Category 1
Eye irritation Category 2
Reproductive toxicant Category 3
Specific target organ toxicity – repeated exposure Category 1
Hazardous to the aquatic environment Category 1
Harmful to terrestrial vertebrates</td></tr>
<tr><td rowspan="2">Detonators
(UN 0030 / UN 0456 / UN 0360)</td><td rowspan="2">Solid article</td><td rowspan="2">1.1B</td><td rowspan="2">1.1B - Substances and articles that have a mass explosion hazard</td><td>10 kg NEQ (10,000 articles)</td><td>SFA: explosive magazine (separate to others)</td></tr>
<tr><td>100 kg NEQ (100,000 articles)</td><td>WUG: Underground chamber (separate to others)</td></tr>
<tr><td rowspan="4">Diesel</td><td rowspan="4">Liquid</td><td rowspan="4">3.1D
6.1E
6.3B
6.7B
9.1B</td><td rowspan="4">Flammable liquids Category 4,
Aspiration hazard Category 1,
See Note 1
Carcinogenicity Category 2,
Hazardous to the aquatic environment chronic Category 2</td><td>80,000 L</td><td>SFA: Services bay at the SFA</td></tr>
<tr><td>6,000 L</td><td>WUG: Portable tanks</td></tr>
<tr><td>550 L</td><td>SFA: Generator tank</td></tr>
<tr><td>150 L</td><td>SFA: Fire pump</td></tr>
</table>

Substance	State of substance	Hazard classification		Proposed maximum volume	Storage Location
		HSNO	GHS7		
Ammonium nitrate emulsion (ANE)	Solid	5.1.1B 6.1E 6.4A 9.1D	Oxidising solids Category 2 Aspiration hazard Category 1, Eye irritation Category 2 Hazardous to the aquatic environment chronic Category 4	40,800 kg	**SFA:** Oxidiser intermediate bulk containers (IBC) storage area
				34,000 kg	**WUG:** Oxidiser IBC storage area
Gasser	Liquid	6.1D 6.4A 6.5B 6.6B 6.9B	Acute oral toxicity Category 4 Eye irritation Category 2 Skin sensitisation Category 1 Germ cell mutagenicity Category 2 Specific target organ toxicity – repeated exposure Category 2	8,000 L	**SFA:** Gasser IBC storage area
				4,000 L	**WUG:** Gasser IBC storage area
Calcium carbonate (Lime)	Solid	6.4A	Eye irritation Category 2	70,000 kg	**SFA:** Lime silo
Oxygen gas	Compressed gas	5.1.2A	Oxidising gas Category 1	60 m^3	**SFA:** Up to ten cylinders in a segregated storage area in the workshop in the SFA
Acetylene gas	Compressed gas	2.1.1A	Flammable gas Category 1A, Chemically unstable gas Category A	20 m^3	**SFA:** Up to four cylinders in a segregated storage area at the workshop in the SFA
Oils, greases*	Liquid	6.1D 6.1E 6.3A 6.4A 6.5B 6.9B 9.1B 9.1C	Acute dermal toxicity Category 4 Aspiration hazard Category 1 Skin irritation Category 2 Eye irritation Category 2 Skin sensitisation Category 1 Specific target organ toxicity – single or repeated exposure Category 2 Specific target organ toxicity – single exposure Category 3 narcotic effects Hazardous to the aquatic environment chronic Category 2 or 3	22,000 kg	**SFA:** Bulk tanks, IBCs or drums in workshop stores: Up to 8,000 kg of raw material and up to 6,000 L of waste oil storage. **WUG:** up to 8,000 L in pods associated with the refuelling activities

1. Skin irritation Category 3 has not been adopted as part of New Zealand's transition to the GHS7 classification system.
* Many of the maintenance oils and greases are non-hazardous. The above table shows the highest individual hazard classifications for the range of workshop substances.

The Class 1 explosive substances will be stored in six H.E magazines (for the ANFO, boosters and packaged explosives) and one I.E magazine (for the detonator devices) at the surface site on Willows Road. Once the underground mine is established, an additional storage facility for Class 1 explosives will be set-up underground near the resource, at a depth of 380 m below the surface. This will also comprise of six separate H.E. chambers and one I.E. magazine. The key hazard associated with these substances is the mass explosion hazard producing a blast overpressure impact around the surface magazine, and at the surface vents for the underground store.

The oxidising substance, ANE, will be stored in a secure bunded compound at the SFA east of the portal entrance, and once the underground mine is established, at two underground stores near the WUG orebody. These stores will be separated from the underground explosives store location by approximately 130 m and 405 m respectively. The key hazard associated with ANE is the acceleration of fire, which requires management through separation from combustible materials. A suitably segregated gasser store will also be established at the SFA and later below ground. Gasser is a liquid with subsidiary low human health hazards by direct exposure.

The ANFO, packaged explosive, boosters and ANE also present human health and environmental hazards. However, the inherent properties of the materials limit their mobility. The ANFO is provided as a granular solid. The boosters and packaged explosive are a granular solid packaged in cardboard tubes and a liquid emulsion in small plastic tubes respectively, and the ANE is a highly viscous emulsion that is considered a solid for the purpose of transport and storage[2]. In the event of a spill, these substances are easily contained and cleaned up with a low risk of contamination of waterways.

Oxygen and acetylene gases will be stored and used at the workshops on the western side of the SFA for welding and cutting tasks. Acetylene is a highly flammable gas and oxygen will accelerate a fire; these gases are incompatible and will be stored separately in well ventilated, secure locations at the workshop.

Diesel, gasser and some of the maintenance oils are liquids with chronic human health hazards. Diesel and some of the oils are also hazardous to aquatic ecosystems. These substances will be stored and used in bunded areas and in areas that drain to stormwater treatment. The distance between the proposed storage locations and OGNZL's boundary limits the potential for off-site persons to come into contact with any released material in the case of a spill.

Similarly, lime has a human health hazard when in direct contact with eye tissue. Lime is a solid powder that is able to be easily managed in the event of a spill. It is stored and used central to the SFA site suitably separated from the site boundary, minimising the chance of contact with the public.

[2] ANE safety data sheet, Orica New Zealand Limited, 27 November 2019

4 Control and management of hazardous substances

4.1 Introduction

The key legislation in New Zealand for management of hazardous substances within the broader regulatory framework are:

- Health and Safety at Work (Hazardous Substances) Regulations 2017 (HSW-HS), which is administered by WorkSafe and sets rules for the storage and use of hazardous substances in the workplace, including risks to workers;
- Health and Safety at Work (Major Hazard Facilities) 2016 Regulations (HSW-MHF) which is also administered by WorkSafe and mandates specific duties relating to process safety that apply to facilities that exceed specified volumes of hazardous substances. These regulations apply to large volumes of hazardous substances and are not triggered by the volumes associated with the proposed WNP activities;
- Hazardous Substances and New Organisms (HSNO) Act and Regulations, which set minimum controls under the Environmental Protection Authority's Hazardous Property Controls Notice 2017 (EPA Notice) to manage the hazards and risks related to all hazardous substances use within domestic environments and from ecotoxic substances in both workplaces and domestic settings; and
- Resource Management Act (RMA), under which District Councils are responsible for the control of actual or potential effects of the use, development, or protection of land.

The Resource Legislation Amendment Act 2017 (RLAA) removed the explicit function of regional and territorial authorities under section 30 and 31 to control the adverse effects of the storage, use, disposal and transportation of hazardous substances to ensure that RMA controls do not duplicate controls in the HSNO Act and Health and Safety at Work Act.

The controls under the HSNO Act and HSW Act provide the minimum protection standards for both on-site and off-site people and environments from the potential adverse effects. However, we note that the controls do not take into account the site-specific context such as the proximity to sensitive waterways or density of nearby residential developments.

4.2 Health and Safety at Work (Hazardous Substances) regulatory controls

Control measures that are triggered under the Health and Safety at Work (Hazardous Substances) regulations (HSW-HS) by the volumes and types of hazardous substances proposed to be stored at the Willows Road portal site and within the WUG are summarised in **Table 4.1** below. The operation is required to comply with all the listed requirements.

These HSW-HS controls are specific to the types of hazards presented by the substances and are implemented to protect people on site from harm. The measures to reduce the likelihood or consequence of an incident to on-site workers will also reduce the risks to off-site people. The controls specified for Class 9 ecotoxic substances duplicate those specified under the EPA Notice which are intended to protect ecosystems when using and storing ecotoxic substances.

Table 4.1: Summary and purpose of HSW-HS requirements

Control measure	Facility and substances	Purpose of control
Signage	SFA • Flammable, oxidising, corrosive, ecotoxic and explosive substances WUG • Flammable, oxidising, ecotoxic and explosive substances	Ensures off-site persons and emergency response personnel are able to identify the hazards at the site and take appropriate precautions.
Secondary containment	SFA • Diesel, ANE, gasser, maintenance oils WUG • Diesel, ANE and gasser	Prevents release of a hazardous liquid to the environment in the event of a failure of primary containment (tank or package) and enables recovery of the substance for safe disposal.
Fire extinguishers	SFA • Diesel, ANE, oxygen and Class 1 explosives WUG • Diesel, ANE and Class 1 explosives	Enables swift emergency response to small fires in areas near hazardous substances to prevent ignition of flammable, explosive or oxidising substances.
Segregation of incompatible substances	SFA • Diesel, ANE, gasser, oxygen, acetylene and Class 1 explosives WUG • Diesel, ANE, gasser and Class 1 explosives	Minimises additional adverse consequences from a spill or fire by preventing reactive substances from mixing in the storage area.
Substance secured from unauthorised access	SFA • ANE and Class 1 explosives WUG • ANE and Class 1 explosives	Limits access to trained personnel and minimises the potential for operator error or tampering.
Emergency response planning	SFA • Diesel, ANE, gasser, lime and Class 1 explosives WUG • Diesel, ANE, gasser and Class 1 explosives	Describes the emergency procedures for a site and takes into account any foreseeable emergency such as a fire, spill or injury. Emergency Response Plans must be regularly tested by the site. These plans help to minimise the consequence of an emergency event, such as through preventing a small spill reaching a drain, extinguishing a small fire or enabling safe evacuation of an effected area.
Separation from public and protected spaces	SFA • Diesel, ANE, acetylene and Class 1 explosives WUG • Diesel, ANE and Class 1 explosives	Minimises any adverse event in the store impacting on public places or protected places, and correspondingly any off-site event from impacting the store.

Control measure	Facility and substances	Purpose of control
Certified handler	SFA • Class 1 explosives WUG • Class 1 explosives	A Certified Handler is a person who is trained and qualified (holds a Certified Handler Compliance Certificate) to handle acutely toxic or explosive substances. This control restricts activities involving these substances to people with demonstrated competency.
Hazardous Substances Location Compliance certification required	SFA • Diesel, ANE and Class 1 explosives WUG • Diesel, ANE and Class 1 explosives	Independently certifies that the hazardous substance location where explosive, flammable, oxidising, toxic or corrosive substances are stored or used, has in place all applicable controls and notifications to manage the hazards (such as segregation of incompatibles, secondary containment, access restrictions).
Stationary Container System Compliance certification required	SFA • Diesel WUG • Diesel	Independently certifies that the tank or process container and associated equipment is safe and complies with the standards for tank design, such as providing secondary containment, pressure relief and overfill protections.
Separation from land use activities according to potential overpressure levels (controlled zones)	SFA • Diesel, ANE and Class 1 explosives WUG • Diesel, ANE and Class 1 explosives	Minimum separation distances for blast overpressure levels are specified to ensure that people and structures are located at a suitable distance from the explosive hazard for protection from adverse effects.
Hazardous areas (ignition source restrictions)	SFA • Diesel, acetylene WUG • Diesel	Prohibits ignition sources from areas where flammable substances are stored to minimise the risk of a fire.
Earthing and bonding of equipment	SFA • Diesel and class 1 explosives WUG • Diesel and class 1 explosives	Minimises risk of an ignition source from build-up of static charge starting a fire at a flammable or explosives store.

4.2.1 Magazine certification

The HSW-HS regulations require any storage of Class 1.1D explosives in excess of 2.5 kg to be secured in a magazine designed and certified to meet requirements for the material of construction, the design of the locking arrangement and arrangements for prevention of removal.

The magazine is also required to have an earthing system between the atmosphere above the hazardous substance location and earth to dissipate any build-up of electrostatic charge. The magazines must also have a lightning interceptor designed in accordance with section 4 in AS/NZS 1768: 2007—Lightning protection. These features are required to minimise the risk of an inadvertent ignition of the explosives.

The magazines used by OGNZL at the surface will be designed to standard AS 2187.1 1998 for relocatable magazines and design compliance certificates will demonstrate that the requirements set in the HSW-HS regulations are met by the proposed magazines.

While the underground chambers are not strictly magazines as would be used on the surface, equivalent standards for security, design and construction will be adhered to, and the facility will be certified by an independent compliance certifier.

4.2.2 Magazine separation

4.2.2.1 Surface magazine

At the surface magazine, the H.E. will be stored in six separate magazines, three containing a maximum of 1,150 kg Net Explosive Quantity (NEQ) and three containing a maximum of 1,300 kg NEQ. Each magazine must be separated by a minimum distance of 27 m, with mounding undertaken in accordance with industry standard 'AS 2187.1, Appendix B', to ensure the distances can be maintained in order to mitigate risk of inter-magazine propagation.

The 10 kg NEQ I.E. magazine may be located within 27 m of another magazine, however, in accordance with AS 2187.1, a minimum offset of 3.5 m (mounded) or 10 m (un-mounded) shall be maintained. The proposed layout of the surface magazine compound is indicated in **Figure 4.1** .

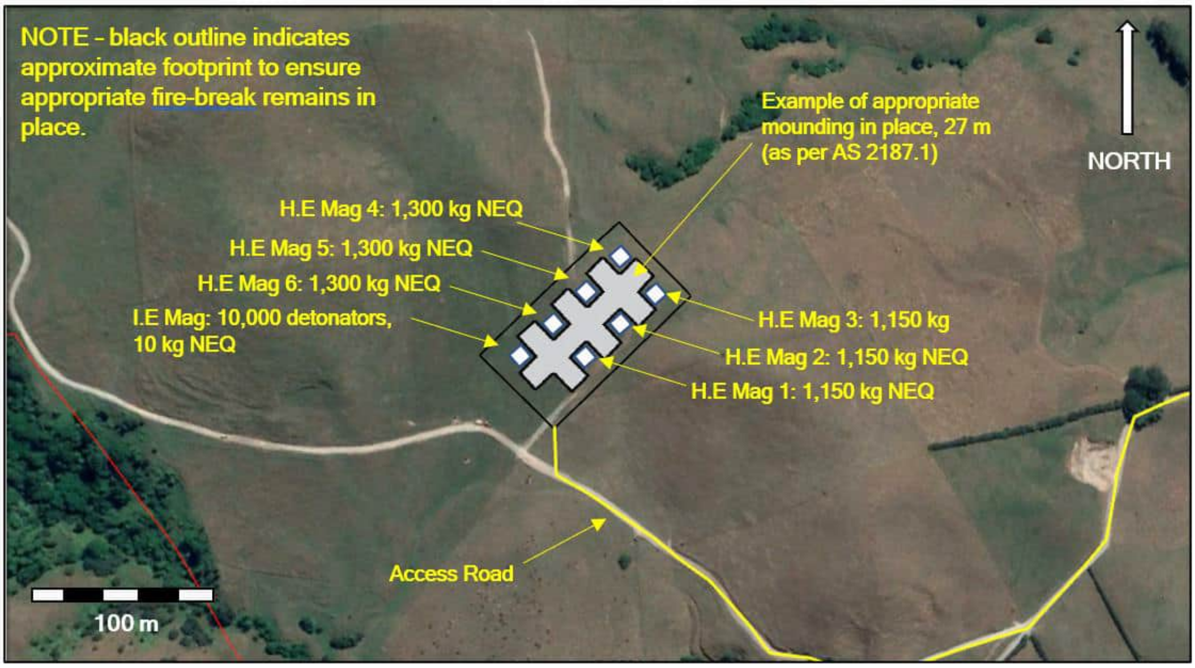

Figure 4.1: Proposed surface magazine layout indicating internal magazine offsets, positioning and NEQ
Source: GSS 2021

4.2.2.2 Underground chambers

The underground storage facility will comprise of six H.E. chambers each containing a maximum of 1,000 kg NEQ and one I.E. chamber containing a maximum of 100 kg NEQ, as illustrated in **Figure 4.2**. The location has been selected as a low traffic area of the WUG, with separation provided to other storage facilities.

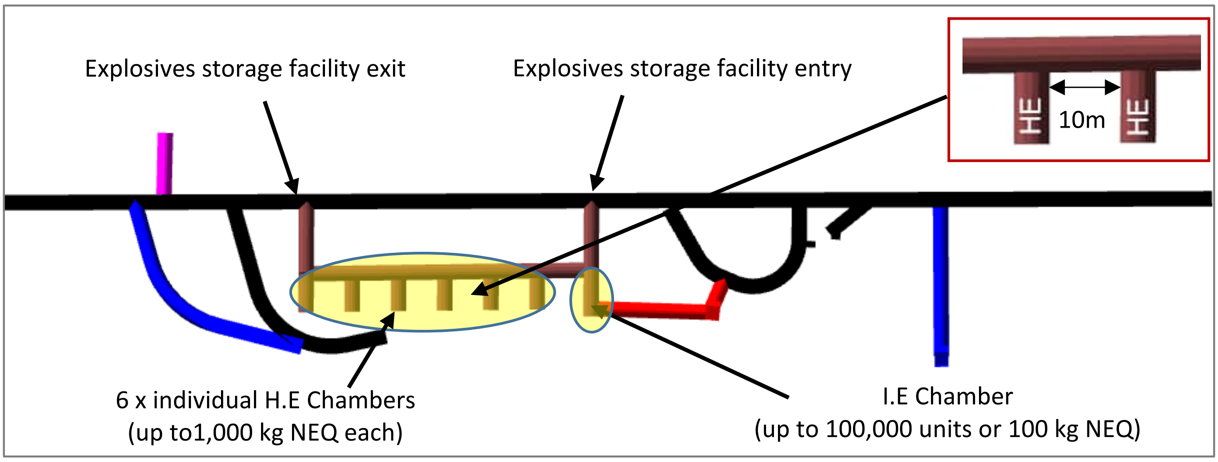

Figure 4.2: Magazine chamber layout including separation distances and proposed stored quantities'
Source: GSS 2021

Each of the seven underground chambers will be separated in order to mitigate risk of propagation between chambers. Two pathways of blast propagation underground are considered in Section 4 of the location assessment report attached as **Appendix B**. These scenarios and the minimum offset distance calculated are summarised in **Table 4.2** below.

Table 4.2: Offset distances

Scenario	Minimum offset required[1]	Provided separation
Blast propagation by rock spall	5 m	10 m
Blast Propagation by Flames and Hot Gases	10 m	
Major Damage Prevention to Interior of Facility	10 m	

1 Calculated in accordance with Annex M of IATG 2.20

The separation distance between the chambers containing 1,000 kg of Class 1 explosive meet the calculated minimum at which blast propagation between chambers is unlikely. The minimum offsets have been calculated on the basis that the NEQ stored has a one-to-one equivalence to trinitrotoluene (TNT) in terms of energy released, when in reality many of the explosives at the facility have a lower TNT equivalence. This assumption results in higher separation requirements with a degree of conservatism.

4.2.3 Hazardous substance location for ANE

4.2.3.1 Surface storage area

The ANE and gasser will be stored in 1,000 L IBCs within a dedicated compound for the oxidising substances at the SFA on the Willows Rd site. This compound will be secured from access by unauthorised personnel. ANE and gasser are incompatible and will be stored in designated areas at a minimum distance of 8 m apart. There will be no combustible materials stored or used within 8 m of the ANE storage area. The closest residence that is not owned by OGNZL is approximately 400 m from this storage area.

The ANE is a highly viscous emulsion that is stored in a solid state, and therefore secondary containment is not required. The storage area is located in the SFA which drains to treatment as described in Section 4.9 to manage any residual contamination. The location will be certified to meet the relevant controls specified in the HSW-HS regulations as set out in **Table 4.1.**

The compound will also be designed to provide designated areas for storage of the empty IBCs such that they are not stored together at any time, given the potential for residual material being present in both.

4.2.3.2 Underground storage area

ANE and gasser will be stored underground in the WUG in three separate chambers – two for ANE and one for gasser (separated from the others by a minimum of 10 m). These chambers have been designed with consideration of legislative, safety and operational objectives, and are suitably separated as required for incompatible substances, as indicated in **Figure 4.3**.

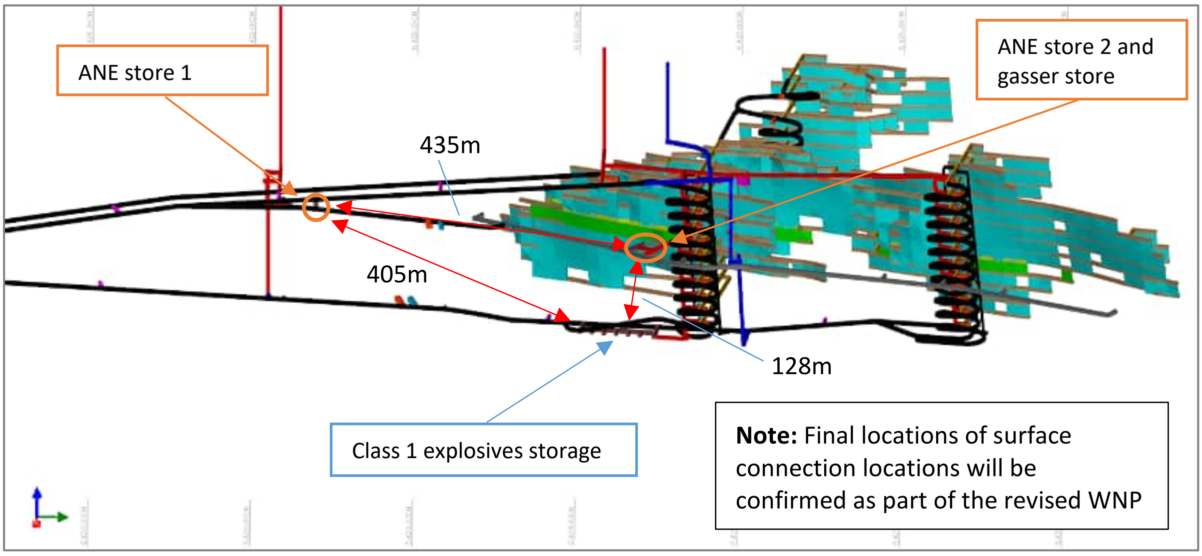

Figure 4.3: Direct slope distances between the different dedicated underground storage areas
Source: OGNZL

Each chamber will have an impervious concrete floor, and the liquid gasser will be stored on bunding for spill containment. The location will be certified to meet the relevant controls specified in the HSW-HS regulations as set out in **Table 4.1**. Signage, a security fence with restricted access gate and safety equipment including fire extinguishers and spill kits will be provided at each store. Primary and exhaust ventilation will also be installed in each chamber.

4.3 Hazardous substances management

The WNP will have strict hazardous substance management procedures in place, which are detailed in OGNZL's indicative Hazardous Substances Management Plan[3] (HSMP) (attached as **Appendix D**) and include:

- Development and maintenance of a hazardous substances register via the ChemAlert database. ChemAlert provides information on the substances' identification, classification and substance specific emergency response guidance.
- Substance Safety Data Sheets (SDS) are kept accessible in hardcopy to all employees on site, and training is provided in interpreting the information provided on the SDS.
- Substance labelling requirements are defined to ensure appropriate identification of the substance hazards pursuant to the Hazardous Substances (Labelling) Notice 2017.

[3] OceanaGold, *Management Plan – Hazardous Substances WAI-250-PLN-003*, (Waihi site, December 2021)

- Development and maintenance of a risk register that identifies the person accountable for managing the risk and the appropriate controls.
- Personal Protective Equipment will be provided to be used as a last line of defence in the hierarchy of controls.
- Spill response kits are available in all work areas where hydrocarbons and other ecotoxic substances are stored or handled. Staff are trained in spill prevention and recovery.
- Effective communication of hazards through daily shift safety meetings, monthly crew safety meetings, safety representative committee meetings, daily management meetings, and task observations for safety performance feedback.

These procedures ensure that staff are trained to identify the hazards associated with each substance and implement measures to prevent spills or fires (depending on the nature of the hazard), minimising the chance of adverse effects at off-site locations.

This HSMP currently applies to OGNZL's activities in Waihi, and will be updated to address any new site-specific hazards associated with the WUG and Willows Road site prior to commission.

4.4 Explosives hazard management

4.4.1 Explosives management plans and responsibilities

The Principal Hazard Management Plan (PHMP) for Explosives sets out the details of management of all aspects of storage, handling and use of explosives at the existing Waihi mining operation.

Hazard management to minimise the risk of an unintended detonation is critical to worker safety on site, as well as for prevention of on-site property damage. Measures to manage the risk of a detonation incident will also minimise the potential for effects on off-site receptors.

The PHMP is attached as **Appendix E**. The proposed magazines will be managed in accordance with the existing procedures for explosives management set out in these management plans. This plan will be updated to address the site-specific matters relevant to the proposed Class 1 storage areas associated with the WUG prior to each site's commission.

The key roles with responsibilities for control of hazards associated with the explosives storage and use on site include:

- Magazine keeper – responsibilities include housekeeping and maintenance of the explosives storage site, signage and locking devices; upkeep of all documentation (licences, certifications and inventory records); and access to keys to magazine site.
- Approved handlers – Certified for safe handling of explosive substances by a WorkSafe accredited external certifier; responsible for supervising all movements of explosives and equipment on site.
- Charge-up operator – The only operator authorised to fire the explosives, which may only be carried out with approval of the Shift Supervisor. The firing must occur from a Designated Firing Point in accordance with the Authorised Charging Plan for compliance with mining consents. Charge plans are signed off by a Production Engineer and peer reviewed by another Mining Engineer or the Senior Engineer.

4.4.2 Security

The proposed explosives storage locations will be securely fenced, and only certified personnel will be authorised to access the keys to the storage site. All sign-outs and returns of the keys are logged in a register and all keys are verified as returned by the magazine keeper at the end of each day.

The storage area at the surface will also be equipped with a point-to-point laser system monitored continuously by site Security, which may only be deactivated by site Security for access by authorised personnel. A remote camera system may additionally be installed.

A security camera will be installed to monitor the gate areas of the underground storage facilities. These cameras are proposed to be monitored by OGNZL security staff.

These security measures will limit access from unauthorised personnel to reduce the likelihood of error, tampering or theft that could cause an incident.

4.4.3 Fire protection systems

The proposed explosives magazines at the surface will be equipped with a heat sensing ‘dry riser’ sprinkler fire suppression system. In addition, two dry chemical powder fire extinguishers (Rating: 30B) are required by the HSW-HS regulations.

The proposed underground storage facility will be equipped with a water deluge fire suppression system in addition to dry chemical powder fire extinguishers required by the HSW-HS regulations.

These fire-fighting facilities will help to reduce the consequence in the event that a fire is initiated at the explosives stores by smothering the ignition source and preventing a detonation.

4.4.4 Ventilation (underground)

The underground storage area ventilation will be designed in accordance with the guidance provided in AS 2187.1 Explosives - Storage, Transport and Use for underground storage. Negative pressure ventilation will exhaust directly from the chamber to the return airways. Louvres that will open in a fail-state will be installed to ensure regulated airflow into the chamber in the event of an emergency.

4.5 Emergency management

Emergency response for any incidents associated with the hazardous substances storage site will be managed under a site-specific Principal Control Plan for Emergency Management. OGNZL’s existing Principal Control Plan - Waihi Emergency Management (see **Appendix F**) serves as an indicative plan in this respect. This control plan sets out the requirements for emergency response for chemical exposure incidents, spills or fire.

In the event of an emergency the relevant operation will alert security via telephone or through a dedicated radio channel. Security will then initiate emergency procedures, which include:

- An overall spill response plan is provided in Appendix L of the WEMP for the main hazardous substances kept at the OGNZL facilities.
- Specific emergency procedures for cyanide, LPG, ANE and hydrogen peroxide are also provided in Appendix L to the WEMP;
- Trigger Action Response Plans (TARP) included as Appendix P to the WEMP detail the appropriate emergency response coordination for a variety of foreseeable incident types. The following scenarios are relevant to the hazardous substance activities:
  - Explosives emergency and explosives fire emergency;
  - Chemical spill or gas leak; and
  - Fire at the surface facilities.

  Each TARP outlines three response levels based on the severity of the incident: Level 1 is localised response managed by the mine staff; Level 2 will involve the dedicated emergency response team with external support on stand-by; and Level 3 warrants external assistance from emergency services and implementation of the OGNZL crisis management plan.

Should a spill and/or gas leak occur, staff will implement the procedures in the WEMP. Spill kits and fire extinguishers will be provided around the mining operation for emergency response, and any clean-up material will be removed from site to a facility authorised for the disposal of hazardous substances. All staff will be trained in the Control Plan and drills for potential scenarios will be held periodically to test the site response and to identify and correct any issues.

In the event of an unintended detonation of explosives or fire in the ANE storage area, OGNZL has an Emergency Response Team on call to respond to any emergency on site and to manage any necessary evacuations of the site and wider community.

The emergency response procedures in place are provided to FENZ for consultation along with any updates to these plans.

Planning for emergency scenarios enables the operator to minimise the consequence of an event to the environment by detailing the appropriate actions.

4.6 Secondary containment

All packaged liquid substances will be stored within secondary containment. The containment capacity will be at minimum the required quantity set out in the HSW-HS as identified in **Table 4.3,** and constructed of material impervious to the substance stored. All substances will be stored such that incompatible substances are segregated.

All storage of diesel (either at the surface or underground) will be in double-skinned tanks which provide full secondary containment.

Provision of secondary containment for hazardous liquids minimises the consequence of a package leak by preventing contact with the environment, and minimises the likelihood of a loss to the environment.

Table 4.3: Secondary containment minimum provisions

Substance	State	HSNO class	Proposed maximum volume	Storage Location	Secondary containment minimum requirement (HSW-HS regulation ref)
ANFO	Solid	1.1D 6.1D 6.3B 6.7B 9.1D	7,350 kg NEQ	**SFA:** Surface explosive magazines (max. 1,300 kg NEQ in any magazine)	Not required for solids
Booster	Solid in card casing	1.1D 6.1C 6.9B 9.1B			Not required for solids
Packaged explosive	Plastic encapsulated emulsion	1.1D 6.1D 6.3A 6.4A 6.8C 6.9A, 9.1A 9.3C	6,100 kg NEQ	**WUG**: Underground chambers (max. 1,000 kg NEQ in any chamber)	Not required for solids
Detonators	Solid article	1.1B	10 kg NEQ (10,000 articles)	**SFA:** Surface explosive magazine (separate to others)	Not required for solids
			100 kg NEQ (100,000 articles)	**WUG**: Underground chamber (separate to others)	
Diesel	Liquid	3.1D 6.1E 6.3B 6.7B 9.1B	40,000 L	**SFA:** Services bay	Containment capacity of at least 110% of the largest container (r17.100) or integral containment[1]: Double skinned containment provided for each tank.
			6,000 L	**WUG**: Refuelling bays	
			550 L	**SFA:** Generator tank	
			150 L	**SFA:** Fire pump	
ANE	Solid	5.1.1B 6.1E 6.4A 9.1D	40,800 kg	**SFA:** Oxidiser storage area	Not required for solids
			34,000 kg	**WUG:** Oxidiser storage area	Not required for solids

Substance	State	HSNO class	Proposed maximum volume	Storage Location	Secondary containment minimum requirement (HSW-HS regulation ref)
Gasser	Liquid	6.1D 6.4A 6.5B 6.6B 6.9B	8,000 L	**SFA:** Gasser storage area	Containment capacity of at least 25% total pooling potential (TPP) or 110% of the largest container whichever is greater: 2,000 L
			4,000 L	**WUG:** Gasser storage	Containment capacity of at least 25% TPP or 110% of the largest container whichever is greater: 1,000 L
Calcium carbonate (Lime)	Solid	6.4A	70,000 kg	**SFA:** Lime silo	Not required for solids
Oxygen	Compressed gas	5.1.2A	60 m^3	**SFA:** Workshop stores	Not required for gases
Acetylene	Compressed gas	2.1.1A	20 m^3	**SFA:** Workshop stores	Not required for gases
Oils, greases	Liquid	6.1D 6.1E 6.3A 6.4A 6.5B 6.9B 9.1B 9.1C	14,000 L 8,000 L	**SFA:** Workshop stores **WUG:** Refuelling bay	These will be provided containment for at least 25% TPP or 110% of the largest container whichever is greater: SFA: 3,500 L WUG: 2,000 L

1. In accordance with the Health and Safety at Work (Reduced Secondary Containment for Certain Above Ground Stationary Tanks) Safe Work Instrument 2017

4.7 Separation requirements

The HSW-HS regulations require separation distances between substances with hazards to human health or property from potentially sensitive locations within the boundary, such as worker lunchrooms or offices, and from any areas off-site where members of the public may be present. The minimum separation distances to protected and public places (including the site boundary) specified in the HSW-HS regulations are designed to mitigate[4] the risk of:

- any adverse event in the store impacting on public places or protected places, and
- any adverse event at public places or protected places impacting on the store.

The separation distances provided to off-site locations are detailed in **Table 4.4** below.

[4] Policy Clarification, Storing class 6 and 8 hazardous substances, WorkSafe NZ, November 2019

Table 4.4: Separation requirements under the HSW-HS for hazardous substances

Substance name	Identified separation requirements	Comments
ANE	Segregated from all incompatible substances, which includes • a substance that is not a class 5.1.1 or 5.1.2 substance but that is classified in class 5.2, or in any of classes 1, 2, 3, 4, 6.1A, 6.1B, 6.1C, or 8 • any organic matter, or substance that contains carbon, in a form that will combust with the class 5.1.1 or 5.1.2 substance • zinc or magnesium in any form, and any other metal in powdered form • any substance or material that will combust with air, or will combust with or catalyse the decomposition of a class 5.1.1 or 5.1.2 substance Minimum separation distances: • 8 m to incompatible substances • 8 m to ignition sources (or 5 m if the packages remain closed at all times)	The ANE is segregated from other hazardous substances in a dedicated store in the SFA and in two dedicated chambers in the WUG. The store at the SFA is approximately 80 m from the nearest OGNZL boundary to the east of the SFA, complying with the separation requirements. The storage areas have been designed to ensure ANE and gasser are separated by a minimum of 10 m. The ANE storage location at the SFA is over 300 m from the surface magazine compound for Class 1 explosives.
Gasser	Segregated from all Class 1 substances, Class 4, Class 5, and Class 8.2A and 8.2B corrosive alkalis/acids.	The storage areas have been designed to ensure ANE and gasser are separated by a minimum of 10 m. The hazard class for gasser does not trigger separation requirements in the HSW-HS to protected or public places. However, the storage location at the surface is over 80 m to the site boundary.
Diesel	Segregated from all Class 1, Class 2, Class 3.2, Class 4, Class 5 substances. The separation distances specified for the largest storage area (80,000 L in the SFA) are as follows: • 5.4 m away from protected areas or the boundary	The closest diesel tank to the boundary in the SFA is separated from the northeast boundary by approximately 35 m. All diesel tanks are segregated from the proposed ANE and gasser storage area.

Substance name	Identified separation requirements	Comments
Oxygen	Segregated from all incompatible substances, which includes • a substance that is not a class 5.1.1 or 5.1.2 substance but that is classified in class 5.2, or in any of classes 1, 2, 3, 4, 6.1A, 6.1B, 6.1C, or 8 • any organic matter, or substance that contains carbon, in a form that will combust with the class 5.1.1 or 5.1.2 substance • zinc or magnesium in any form, and any other metal in powdered form • any substance or material that will combust with air, or will combust with or catalyse the decomposition of a class 5.1.1 or 5.1.2 substance A minimum separation of 3 m to incompatible substances and ignition sources applies to storage of oxygen cylinders.	The oxygen gas cylinders will be stored at the workshop in the SFA in a secure location with chains for cylinder restraint. Oxygen and acetylene gas storage will be segregated. The workshop is approximately 100 m from the nearest site boundary to the northeast. The workshop is approximately 100 m from the nearest site boundary at Mataura Stream to the northeast, and over 40 m from the ANE store.
Acetylene	Segregated from all Class 1, Class 2.1.2, Class 3, Class 4, Class 5 substances. The separation distances specified for the acetylene: • 5 m away from protected areas, public places or the boundary	The acetylene will be secured upright in a dedicated location against the workshop on the western portion of the SFA. The workshop is approximately 100 m from the nearest site boundary to the northeast. The acetylene storage area will be segregated from any storage of oxygen gas cylinders.

4.8 Refuelling areas

During tunnelling, refuelling of equipment will be undertaken via a dedicated fuel truck, drawing from a surface located self-bunded isotainer located in the SFA with a nominal capacity of 80,000 litres. As the tunnel progresses, up to two self-bunded and appropriately certified tanks will be installed underground to store up to 6,000 L of diesel and up to 8,000 L of maintenance oils each in packages stored in a bunded area for underground use. The portable diesel tanks have been selected as they are suitable for underground refuelling units, which include features like thermally and manually activated fire enclosure with dry chemical fire suppression, 110% spill containment around the tank and pumps and automatic shut off valves.

Each refuelling bay will be located in a sealed area with kerbing to prevent clean water flowing into the area. The refuelling pad will drain to an oil-water separator to treat any residual contamination of run-off prior to release to the stormwater collection ponds east of the SFA.

4.9 Water treatment

In the event of a spill at the SFA hard stand at Willows Road, spill containment and clean-up will be initiated by OGNZL staff. However, any residual contamination of surface run-off water will be treated via oil/water separators at the refuelling bay and directed to a series of small dedicated solid settling ponds east of the SFA prior to discharge to the Mataura Stream that crosses the Willows

Road farm. The WNP includes a stormwater monitoring programme for discharges from the collection ponds and for water quality within the Mataura Stream.

A clean stormwater swale will direct any stormwater flowing overland from the south and west of the SFA around the perimeter to discharge to the Mataura Stream. Surface drainage plans for the SFA are shown in **Appendix C.**

Contact water collected within the tunnel and WUG will be collected and pumped to a surface holding pond at the Willows Road site. Suitable water from this pond may be diverted and reused underground in mine equipment or for dust suppression at the surface. The balance of water from this holding pond will be pumped to the existing Water Treatment Plant in Waihi for treatment and subsequent reuse or discharge in accordance with the consent conditions that apply to that discharge.

4.10 Signage

Signage will be provided at the entrance to the Willows Road site to identify the substances present, the class and action to be taken in an emergency. Substance-specific signage will be displayed at each storage location, such as at the explosive magazine compound, or the ANE store.

4.11 Transport of hazardous substances

The delivery of hazardous substances will be by truck via State Highway 25 and Willows Road and internal access roads within the OGNZL landholding. Deliveries are anticipated for each substance on a weekly basis at peak demand as detailed in **Table 4.5**.

Any transport of hazardous substances will also be in accordance with the Land Transport Rule: Dangerous Goods 2005, which includes requirements for packaging, labelling, loading restrictions, segregation of incompatibles, unloading inspections and recurrent driver training. All movements of explosives around the site are under the supervision of a Certified Handler.

During Stage One, a significant portion of deliveries to drill sites will be made by helicopter, which may disembark from the Willows Road farm site. Transport of hazardous substances via helicopter will adhere to the Civil Aviation Rule Part 92 – Carriage of Dangerous Goods, with requirements for packaging, labelling, loading restrictions, segregation of incompatibles, unloading inspections and recurrent training.

Table 4.5: Delivery schedule for substances associated with the WUG and Willows Road site

<table>
<tr><th>Substance</th><th>HSNO class</th><th>Proposed maximum volume</th><th>Storage location</th><th>Delivery frequency</th><th>Delivery volume</th></tr>
<tr><td>ANFO</td><td>1.1D
6.1D
6.3B
6.7B
9.1D</td><td rowspan="3">7,350 kg NEQ

6,100 kg NEQ</td><td rowspan="3">Surface explosive magazines (max. 1,300 kg NEQ in any magazine)

Underground chambers (max 1,000 kg NEQ in any chamber)</td><td rowspan="3">Weekly</td><td rowspan="3">2000 kg NEQ</td></tr>
<tr><td>Booster</td><td>1.1D
6.1C
6.9B
9.1B</td></tr>
<tr><td>Packaged explosive</td><td>1.1D
6.1D
6.3A
6.4A
6.8C
6.9A
9.1A
9.3C</td></tr>
<tr><td rowspan="2">Detonators</td><td rowspan="2">1.1B</td><td>10 kg NEQ (10,000 articles)</td><td>Surface explosive magazine (separate to others)</td><td>Weekly</td><td>2,450 units</td></tr>
<tr><td>100 kg NEQ (100,000 articles)</td><td>Underground chamber (separate to others)</td><td>Weekly</td><td>2,450 units</td></tr>
<tr><td rowspan="4">Diesel</td><td rowspan="4">3.1D
6.1E
6.3B
6.7B
9.1B</td><td>80,000 L</td><td>Services bay at the SFA</td><td>Weekly</td><td>20,000 L</td></tr>
<tr><td>6,000 L</td><td>WUG portable tank</td><td>Daily</td><td>6,000 L</td></tr>
<tr><td>550 L</td><td>Generator tank at the SFA</td><td>Sporadic</td><td>550</td></tr>
<tr><td>150 L</td><td>Fire pump at the SFA</td><td>Sporadic</td><td>150</td></tr>
<tr><td rowspan="2">Ammonium nitrate emulsion (ANE)</td><td rowspan="2">5.1.1B
6.1E
6.4A
9.1D</td><td>40,800 kg</td><td>Oxidiser IBC storage area – SFA</td><td>Weekly</td><td>30,000 kg</td></tr>
<tr><td>34,000 kg</td><td>Oxidiser IBC storage area – underground</td><td>Weekly</td><td>30,000 kg</td></tr>
</table>

Substance	HSNO class	Proposed maximum volume	Storage location	Delivery frequency	Delivery volume
Gasser	6.1D 6.4A 6.5B 6.6B 6.9B	8,000 L	Gasser IBC storage area – SFA	Weekly	1,000 L
		4,000 L	Gasser IBC storage area – underground	Weekly	1,000 L
Calcium carbonate (Lime)	6.4A	70,000 kg	Lime silo in SFA	Monthly	30,000 kg
Oxygen	5.1.2A	60 m^3	Cylinder storage in workshop at SFA	Monthly	30 m^3
Acetylene	2.1.1A	20 m^3	Cylinder storage in workshop at SFA	Monthly	10 m^3
Oils, greases*	6.1D 6.1E 6.3A 6.4A 6.5B 6.9B 9.1B 9.1C	14,000 L	Bulk tanks, IBCs or drums in workshop stores in SFA	Monthly	10,000 L
		8,000 L	1,000 L pods in WUG refuelling area		

4.12 Waste management

The only potentially hazardous waste anticipated as a part of the storage of explosives is the packaging, which may be contaminated with explosive residue. The method for disposal of packaging is set out in OGNZL's Disposing of Explosives and Packaging Procedure and involves controlled destruction by a Certified Handler at a designated controlled-access burn-off-site. This procedure will be followed at all times.

If required, ANFO may be disposed of by dissolving with water; this is to be done under direct supervision of an authorised person. Where the quantity of explosives to be disposed of is significant (>10 kilograms packaged product), it will be stored and returned to the supplier for disposal.

Hazardous waste associated with the use of ANE and gasser within the WUG includes the empty IBCs which are removed to the surface, collected in their designated area of the storage compound in the SFA, before removal off-site to an authorised hazardous waste facility.

Waste oils generated though maintenance of machinery at the workshop in the SFA will be stored in bunded tanks or packages for periodic removal off-site by authorised waste contractors.

Any hazardous waste generated through a spill event is to be notified to the Manager of Sustainability. The Manager ensures that disposal is in accordance with the relevant OGNZL Compliance Standards, and Regional and Local authority requirements.

5 Resource consent requirements

The HDP uses the Hazardous Facilities Screening Procedure (HFSP) to determine the consent activity status of activities involving hazardous substances based on the calculated effects ratio for the activity. The permitted effects ratio specified for activities within the Rural zone is 0.25, which applies to the surface facilities at the Willows Road site.

The HFSP for the proposed hazardous substances stored in the Rural Zone adjacent to the portal entrance at Willows Road is attached as **Appendix G**. The explosive storage has been input as if it were entirely booster explosives, as these have the highest human health and environment hazard rating for all three effect types (all explosives have the same fire/explosion hazard rating).

The effects ratio for each effect type is summarised below:

- Fire/Explosion effect ratio: 38.4
- Human health effect ratio: 3.3
- Environment effect ratio: 3.0

Each effect ratio exceeds the Rural Zone permitted effects ratio for the storage and use of hazardous substances at the portal location and is therefore a restricted discretionary activity under Rule 7.7.8(1)(a).

There is no permitted effects ratio specified for activities within the Conservation (Indigenous Forest) zone, and as such the storage and use of explosives, oxidisers and diesel within the tunnel and WUG is a non-complying activity under Rule 7.7.10.1.

Rule 7.7.14 of the HDP lists activities that are exempt from consideration and includes (i) *Fuel in motor vehicles, drilling rigs, boats and small engines such as weedeaters, lawnmowers, chainsaws etc.* As such, fuel in use within vehicles and equipment has not been included in this assessment (though refuelling activities are considered). We note that any incident involving fuel in equipment will be subject to OGNZL's emergency response procedures to contain and clean up the spilled material.

Proposed conditions for management of hazardous substances at these locations are included in the conditions set appended to the overarching AEE.

6 Overpressure offset distances assessment

6.1 Overview

The HSW-HS regulations specify minimum offset distances around explosive magazine locations such that, in the event of an unintended initiation, specified activities are not subject to blast overpressures greater than specified. The blast overpressure is the sudden onset of a pressure wave after an explosion. The areas within these overpressure radii are referred to as ‘controlled zones’ and under regulation 9.27 of the HSW-HS (“PCBU to control adverse effects of unintended initiation”), certain activities must be excluded.

The minimum offset distances for the proposed Class 1 storage areas were calculated in the two location assessment reports prepared by GSS (**Appendix A** and **Appendix B**) and are summarised in the sections below.

The regulations specify these minimum offset distances “to ensure that any potential adverse effects are managed and minimised. This includes making sure that people and structures are well protected and are located at a suitable distance from the explosives.”[5]

6.2 Surface magazine offsets

The total aggregate quantity of stored H.E product (7,350 kg NEQ) is divided across six separate H.E magazine units at the surface. As illustrated in **Figure 4.1**, the largest of the magazines will be restricted to a maximum of 1,300 kg NEQ of mixed grade H.E. An additional 10 kg NEQ of I.E (detonators) is to be stored in an entirely separate magazine unit (I.E Magazine). The minimum offset distances that constitute the controlled zones for the proposed Class 1 storage facility were calculated in a feasibility study report prepared by Global Seismic Solutions (July 2021) and are summarised in **Table 6.1** below. To allow flexibility in the positioning of the I.E magazine, all controlled zone calculations assume the quantity may be up to 1,310 kg (NEQ). The report used a TNT equivalent of 1.0 to calculate conservative offset distances. In reality, ANFO has a TNT equivalence of approximately 0.74 so these distances will be conservatively high for the mix of explosives proposed.

Table 6.1: Summary of calculated offset distances for the proposed explosives storage site at Willows Road (GSS, 2021)

Ref	Exclusion from zone	Blast overpressure	Offset distance	Comment
r 9.27 (2)(a)(i)	Public traffic routes of low density and places where people may occasionally be present in numbers up to 200 persons on average in any 24-hour period	13 kPa	121 m	Area within OGNZL owned land. Separation of over 300 m to on-site worker facilities at the SFA.
r 9.27 (2)(b)(i)	Public traffic routes of medium density, places where people may occasionally be present in numbers up to 900 persons on average in any 24-hour period, and the interior of any proximate building within the boundary of the place where people not directly handling explosive substances	9 kPa	160 m	

[5] Explosives (including pyrotechnics) - Blast Overpressure. https://www.worksafe.govt.nz/topic-and-industry/hazardous-substances/guidance/substances/explosives/ Retrieved 20 May 2022

Ref	Exclusion from zone	Blast overpressure	Offset distance	Comment
r 9.27 (2)(c)(i)	Public traffic routes of high density, areas of high intensity land use, or any area where a person may be legally present inside the boundary of the place where the hazardous substance location is located	5 kPa	255 m	
r 9.27 (2)(d)	Vulnerable facilities defined in the HSW-HS regulations as: a) buildings of 4 storeys or more, of curtain wall construction with panels more than 1 500 mm square: b) buildings of 4 storeys or more with more than 50% of the wall area glazed: c) a hospital care institution, residential disability care institution, or rest home (as defined in section 58(4) of the Health and Disability Services (Safety) Act 2001), early childhood education and care centre (as defined in section 310 of the Education Act 1989), or school (as established under section 146 of the Education Act 1989): d) public buildings or structures of historic value: e) major transport and traffic terminals such as railway stations and airports handling more than 1 800 people in 24 hours: f) major public utilities whose service could be disrupted by a blast of 5 kPa: g) any similar facilities.	2 kPa	507 m	No vulnerable facilities currently within this zone.
r 9.27 (4)	A PCBU with management or control of a hazardous substance location that is used solely for securing and holding a class 1 substance must limit the quantities of any class 1 substance at the location to ensure that, in the event of an unintended initiation - the interior of any proximate building where a class 1 substance is manufactured would not be subject to a blast overpressure of more than 24 kPa.	24 kPa	79 m	No Class 1 manufacturing proposed within the radius described.

The overpressure offset distances are illustrated in **Figure 6.1** below, showing areas of overlap with neighbouring properties.

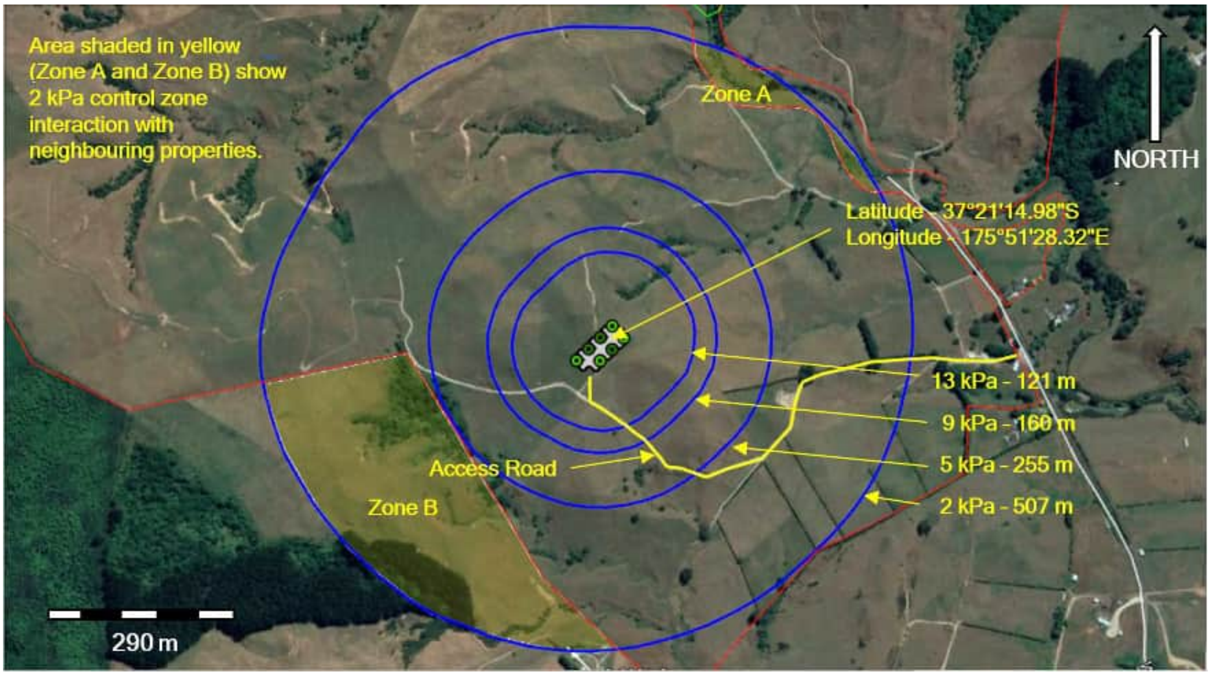

Figure 6.1: Overpressure zones offset distances *Source: GSS (October 2021)*

As identified on **Figure 6.1**, the 2 kPa blast overpressure radius crosses the site boundary at the northeast (Zone A) and southwest (Zone B) of the proposed stores. The underlying land zone for the neighbouring property to the southwest is Rural and to the north is Conservation (Indigenous Forest) Zone. People present in these areas could experience up to 5 kPa overpressure in a worst-case scenario in Zone B at the closest point to OGNZL's boundary west of the surface magazine compound. There are no dwellings in the overlapping area, however there is a farm shed approximately 500 m south of the magazines' location.

The properties that are overlapped by the 2 – 5 kPa blast overpressure zone have been evaluated to determine whether the underlying zoning in the HDP permits the construction of vulnerable facilities in **Table 6.2** below.

Quantitative analysis of the consequence of exposure to this level of overpressure is provided in Section 7.3.2.1.

The purpose of the requirement to exclude these activities from the 2 kPa overpressure radius in the HSW-HS is to protect vulnerable facilities from effects in an explosion scenario. Therefore, compliance with these requirements ensures that impacts on sensitive activities are minimised.

Table 6.2: Assessment of potential for establishment of Vulnerable Facilities at off-site properties in the 2 kPa blast overpressure zone

Vulnerable facility definition (HSW-HS 2017)	Conservation (Indigenous Forest) zone	Rural zone
Buildings of 4 storeys or more, of curtain wall construction with panels more than 1,500 mm square:	Not permitted – height restriction of 6 m (permitted) and 8 m (RD)	Not permitted - Only dwellings and buildings accessory to farming permitted.

Vulnerable facility definition (HSW-HS 2017)	Conservation (Indigenous Forest) zone	Rural zone
Buildings of 4 storeys or more with more than 50% of the wall area glazed:	Not permitted – height restriction of 6 m (permitted) and 8 m (RD)	Not permitted – Only dwellings and buildings accessory to farming permitted.
A hospital care institution, residential disability care institution, or rest home (as defined in section 58(4) of the Health and Disability Services (Safety) Act 2001), early childhood education and care centre (as defined in section 310 of the Education Act 1989), or school (as established under section 146 of the Education Act 1989):	Not permitted.	Not permitted – Only dwellings and buildings accessory to farming permitted.
Public buildings or structures of historic value:	Permitted but none established or proposed.	Permitted but none established or proposed.
Major transport and traffic terminals such as railway stations and airports handling more than 1,800 people in 24 hours:	Not permitted.	Not permitted.
Major public utilities whose service could be disrupted by a blast of 5 kPa:	Permitted but none established or anticipated.	Permitted but none established or anticipated.
Any similar facilities.	Permitted but none established or anticipated.	Permitted but none established or anticipated.

6.3 Underground explosives storage facility offsets

The proposed underground storage facility will consist of seven separate purpose-built chambers, six of which are dedicated to H.E. and one for the I.E. as shown in **Figure 4.2**.

In the event of an unintended detonation, the overpressure would propagate through the mine space and be expelled at the surface vents. Controlled zones that restrict access to areas that may be subject to overpressure levels specified in r9.27 of the HSW-HS must be established for each surface connection. These areas are where the blast overpressure will be vented and where impacts on off-site people or public could be anticipated.

The location assessment report by GSS (**Appendix B**) for the underground storage facility details the minimum offset distances for the five surface connections that were previously proposed to be installed at the Willows Road farm (portal entrance and one fresh air intake) and above the WUG in the Coromandel Forest Park (two fresh air intakes and one return air rise). It is now anticipated that up to four (two fresh air intakes and two return air rises) may be established within the Coromandel Forest Park, and the exact locations of these will be determined following further geotechnical and hydrogeological testing undertaken as part of Stage One of the WNP.

The proposed quantity of explosives in storage has not changed, and as such, the previously assessed vent locations are expected to be generally representative of the overpressure effects at the surface above the WUG.. The addition of a second return air rise above the WUG is not expected to alter the overpressure levels experience at the surface, other than to potentially reduce the extent of the controlled zones by spreading the total pressure release between more vents.

The GSS 2021 overpressure levels are summarised in **Table 6.3** below. The overpressure value calculated assumes that an entire chamber detonates at once and that the chamber is at maximum capacity, and will therefore be conservatively high. Additionally, the volume of the underground mine used for calculation of the blast pressure has considered the travel path volume to the surface vents only, which will underestimate the total mine volume by excluding some of the available mine space and therefore conservatively overestimates the predicted pressure at the surface vents.

The storage facility has been designed with separation distances between the different chambers, such that the risk of explosion propagation between explosive components is mitigated (See Section 4.2.2.2). Therefore, the scenario considered for the calculation of controlled zones at the surface vents is a detonation at the largest of the chambers, where a maximum of 1,000 kg of Class 1 explosives are proposed to be stored. Full calculation of the blast overpressure can be found in **Appendix B.**

Table 6.3 below sets out the calculated offset distances (to the nearest metre) for five surface connection sites and compares them with the requirements of r9.27. The Waihi Portal (Site 1) is not considered due to its large distance from the WUG, and negligible effect anticipated.

Table 6.3: Summary of calculated offset requirements for the proposed explosives storage site (GSS, 2021)

	Control zone offset distance (m) required for:				
Overpressure / Site[2]	Vulnerable Facilities	Inhabited building distance / Public traffic route	Interior of buildings	Public Places / Low density traffic routes	Process building[1]
	2 kPa	5 kPa	9 kPa	13 kPa	24 kPa
Site 2 – Willows Portal	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Site 3 – Willows Rd Farm Fresh Air Intake	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Site 4 – WUG Fresh Air #1	3.8	3.5	2.9	2.3	< 1.0
Site 5 – WUG Return Air #1	4.7	4.4	3.7	2.9	< 1.0
Site 6 – WUG Fresh Air #2	3.8	3.5	2.9	2.3	< 1.0

1 Location of Class 1 explosives manufacture.

2 Site names have been aligned with those identified in more recent reporting for consistency

The excluded activities are considered at each site with regards to the largest calculated overpressure radius in **Table 6.4** below. The largest was the 4.7 m radius for 2 kPa around the Site 5 (WUG Return Air #1) connection. Overpressure levels at any selected vent location above the WUG are expected to be consistent with this distance, within a few metres.

There are no activities that are required to be excluded under the HSW-HS for protection of people and structures (such as public traffic routes, vulnerable facilities etc.) anticipated within the controlled zone radii.

Table 6.4: HSW-HS exclusion requirements of r9.27

Ref	Exclusion from zone	Blast overpressure	Max. offset distance[1]	Comment
r 9.27 (2)(a)(i)	Public traffic routes of low density and places where people may occasionally be present in numbers up to 200 persons on average in any 24-hour period	13 kPa	2.9 m	Surface connections Site 1 and Site 2 are within OGNZL owned land with no nearby public access. The three sites (Site 4, Site 5 and Site 6) that are located in the Coromandel Forest Park could in theory be accessed by a member of the public. However, each ventilation shaft is securely fenced-off in a 10 m x 10 m compound such that in practice the public would not be within the 13 kPa overpressure radius.
r 9.27 (2)(b)(i)	Public traffic routes of medium density, places where people may occasionally be present in numbers up to 900 persons on average in any 24- hour period, and the interior of any proximate building within the boundary of the place where people not directly handling explosive substances	9 kPa	3.7 m	
r 9.27 (2)(c)(i)	Public traffic routes of high density, areas of high intensity land use, or any area where a person may be legally present inside the boundary of the place where the hazardous substance location is located	5 kPa	4.4 m	
r 9.27 (2)(d)	Vulnerable facilities defined in the HSW-HS regulations as: h) buildings of 4 storeys or more, of curtain wall construction with panels more than 1 500 mm square: i) buildings of 4 storeys or more with more than 50% of the wall area glazed: j) a hospital care institution, residential disability care institution, or rest home (as defined in section 58(4) of the Health and Disability Services (Safety) Act 2001), early childhood education and care centre (as defined in section 310 of the Education Act 1989), or school (as established under section 146 of the Education Act 1989): k) public buildings or structures of historic value: l) major transport and traffic terminals such as railway stations and airports handling more than 1 800 people in 24 hours: m) major public utilities whose service could be disrupted by a blast of 5 kPa: n) any similar facilities.	2 kPa	4.7 m	There are no structures meeting the definition of vulnerable facilities located in the vicinity of the surface vents, nor is construction of any such structures anticipated in the Coromandel Forest Park in Wharekirauponga or at the OGNZL owned Willows Road site. This radius will extend 2.5 m from the perimeter fence in the maximum case.

Ref	Exclusion from zone	Blast overpressure	Max. offset distance[1]	Comment
r 9.27 (4)	A PCBU with management or control of a hazardous substance location that is used solely for securing and holding a class 1 substance must limit the quantities of any class 1 substance at the location to ensure that, in the event of an unintended initiation - the interior of any proximate building where a class 1 substance is manufactured would not be subject to a blast overpressure of more than 24 kPa.	24 kPa	1 m	There are no Class 1 manufacturing operations either existing or proposed within the radius described at any of the surface connections.

1. For surface connections identified in the GSS 2021 reporting. Final surface connection locations are expected to have comparable overpressure radii.

It is considered that the controlled zones will be restricted to sufficiently minimise the risk to the public. Theoretically, the 2 kPa overpressure zone extends up to 2.5 m beyond the fence perimeter for the surface connections in the Coromandel Forest Park as assessed in 2021. However, given the conservative nature of the calculation (complete instantaneous detonation of a full underground chamber and use of limited underground mine volume), the low likelihood of a member of the public being in the vicinity of the vents during an accidental detonation in the store, and that people exposed to less than 3.5 kPa overpressure are expected to have a very low chance of injury (see Section 7.3.2.1), this is considered acceptable.

There are no residences or buildings within approximately 3 km of the WUG and underground Class 1 explosives storage facility, and therefore the effect of vibration on structures has not been considered in this assessment.

7 Risk Assessment for Hazardous Substances

7.1 Introduction

The following sub-sections set out a risk assessment of the proposed storage, handling and use of hazardous substances at the Willows Road portal entrance site and in the WUG.

The risk assessment involves consideration of:

- Identification of potential hazards, failure modes and exposure pathways;
- The sensitivity of the surrounding environment;
- The separation distances from neighbouring activities and the number of people potentially at risk from the facility;
- Cumulative risks of hazardous facilities in the area; and
- Transport of hazardous substances on and off the site to ensure safe access and appropriate routes for delivery vehicles around the site to minimise risk of spillage.

7.2 Assessment method

In the absence of a New Zealand specific guidance, the New South Wales Department of Planning (NSW DoPI) Multi-Level Risk Assessment[6] approach was considered in development of the methodology for this assessment. The Multi-Level Risk Assessment approach is summarised in **Figure 7.1**. There are three levels of assessment, which are:

- Level 1 – Qualitative Analysis, primarily based on the hazard identification techniques and qualitative risk assessment of consequences;
- Level 2 – Partially Quantitative Analysis, using hazard identification and the focused quantification of key potential off-site risks; and
- Level 3 – Quantitative Risk Analysis (QRA) based on the full detailed quantification of risks, consistent with Hazardous Industry Planning Advisory paper No.6 – Guidelines for Hazard Analysis.

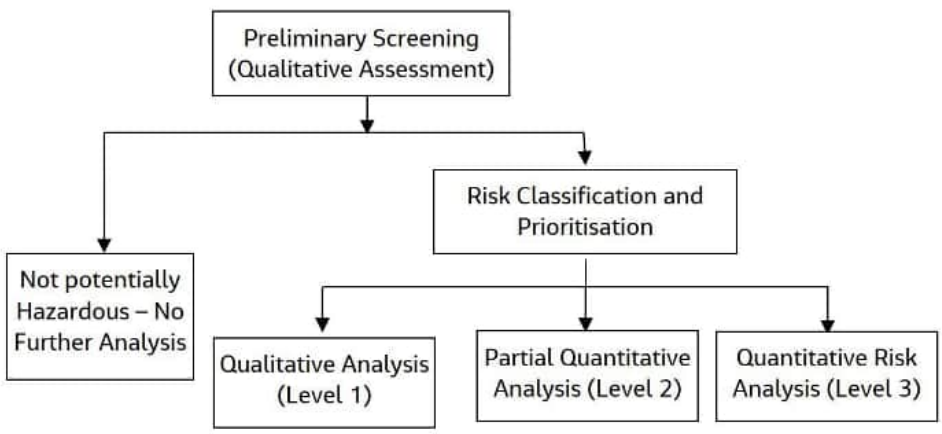

Figure 7.1: Multi-Level Risk Assessment flow diagram *Source: NSW-PD*

The risk assessment provides a screening level assessment, where all hazards in terms of their risk to people beyond the site boundary are assessed to identify any significant risks to off-site

[6] Assessment Guideline Multi-Level Risk Assessment, New South Wales Department of Planning, 2011

environments. Where these are limited to specific individual hazards, partial quantification is applied for potentially high consequence events with a low frequency of occurrence beyond the site boundary. A detonation in the explosives store is identified in the HSW-HS as a potentially high consequence event that requires assessment using empirical calculations. This is expanded upon for the Surface Class 1 explosives store and the WUG Class 1 explosives store in Section 7.3.2.

7.3 Risk assessment

7.3.1 Hazard analysis

The hazards associated with hazardous substances are generally classified as follows:

- Fire/Explosion Effects: concerned with damage to property, the built environment and safety of people;
- Human Health Effects: concerned with the well-being, health and safety of people; and
- Environmental Effects: concerned with damage to ecosystems and natural resources.

These hazards are based on the intrinsic characteristics of the substance, for example the flashpoint of a flammable substance. **Table 7.1** sets out the hazard analysis for the site, identifying and rating potential hazards.

The hazard ratings, based on the failure pathway and affected environment, have been assessed as high for storage of explosives and oxidisers and low-to-moderate for spills of gasser and diesel. Substances that, in the absence of controls, could have off-site effects are evaluated in the qualitative risk analysis in Section 7.3.2.

Where the residual risk of an event to an off-site location could be significant, a partial quantitative review of the consequence is undertaken in Section 7.3.2 (in this case this has been considered for the Class 1 explosives).

Table 7.1: Hazard analysis

Hazardous substance and quantity stored	Identification of potential hazard properties (Hazard level[1])	Failure Modes	Exposure pathways / Affected part of environment	Indicative hazard rating	Potential for off-site effects	
ANFO 7,350 kg (surface) 6,000 kg (underground)	Fire/Explosion effects (high) Human health (low) Ecotoxicity (low)	Fire in storage area; Spill to environment during delivery or movement	People, property, ecosystems	Low hazard to ecosystems as substance is a granular solid. High explosion hazard.	Yes	Effects due to fire/explosion to be considered further in risk analysis.
Booster 7,350 kg (surface) 6,000 kg (underground)	Fire/Explosion effects (high) Human health (moderate) Ecotoxicity (high)	Fire in storage area; Spill to environment during delivery or movement	People, property, ecosystems	Low hazard to ecosystems as substance is packed into small individual cardboard or plastic units. High explosion hazard.	Yes	Effects due to fire/explosion to be considered further in risk analysis.
Packaged explosive 7,350 kg (surface) 6,000 kg (underground)	Fire/Explosion effects (high) Human health (low) Ecotoxicity (high)	Fire in storage area; Spill to environment during delivery or movement	People, property, ecosystems	Low hazard to ecosystems as substance is packed into small individual plastic units. High explosion hazard.	Yes	Effects due to fire/explosion to be considered further in risk analysis.
Detonators 10 kg (surface) 100 kg (underground)	Fire/Explosion effects (high)	Fire in storage area;	People, property	High explosion hazard.	Yes	Effects due to fire/explosion to be considered further in risk analysis.
ANE 40,800 L (surface) 34,000 kg (underground)	Fire/Explosion effects (high) Ecotoxicity (low)	Fire in storage area; Spill to environment during delivery or movement	People, property, ecosystems	Low hazard to the environment as substance is a highly viscous emulsion, considered a solid for storage and transport purposes. High fire hazard.	Yes	Effects due to fire/explosion to be considered further in risk analysis.

Hazardous substance and quantity stored	Identification of potential hazard properties (Hazard level[1])	Failure Modes	Exposure pathways / Affected part of environment	Indicative hazard rating	Potential for off-site effects	
Gasser 8,000 L (surface) 4,000 kg (underground)	Human health (low) Ecotoxicity (low)	Spill to environment during delivery or movement	People, ecosystems	Low hazard to human health, substance would need to come into direct contact with a person off-site. Substance is stored in a bunded area and used underground.	Yes	Effects on ecosystems due to a spill to be considered further in risk analysis.
Diesel 80,700 L (surface) 6,000 L (underground)	Fire/Explosion effects (low) Human health (low) Ecotoxicity (medium)	Fire in storage area; Spill to environment during delivery or movement	People, property, ecosystems	Low hazard to human health and for fire as diesel has low flammability and will be stored in a dedicated area segregated from ignition sources. Moderate hazard to the environment in a spill.	Yes	Effects due to a fire or a spill to be considered further in risk analysis.
Calcium carbonate (lime) 70,000 kg	Human health (low)	Spill to environment during delivery or movement Rupture of silo	People, ecosystems	Low hazard to human health, substance would need to come into direct contact with the eye tissue of a person off-site. Substance is stored in a silo at the surface infrastructure area. Silo is fitted with fabric filters for dust emission control.	No	Effects not considered further in risk analysis.
Oxygen 60 m^3	Fire/Explosion effects (high)	Fire in storage area	People, property	High fire hazard	Yes	Effects due to fire to be considered further in risk analysis.
Acetylene 20 m^3	Fire/Explosion effects (high)	Fire in storage area	People, property	High fire hazard	Yes	Effects due to fire to be considered further in risk analysis.

Hazardous substance and quantity stored	Identification of potential hazard properties (Hazard level[1])	Failure Modes	Exposure pathways / Affected part of environment	Indicative hazard rating	Potential for off-site effects	
Oils and grease 14,000 kg (surface) 8,000 kg (underground)	Ecotoxicity (low to high)	Container leak or rupture during unloading or storage.	Ecosystems	Low to high hazard to ecosystems in the event of a spill	Yes	Effects on ecosystems to be considered further in risk analysis.

1. A hazard level is assigned to each hazard class in the Land Use Planning Guide for Hazardous Facilities, MfE 2000.

7.3.2 Partial Quantitative analysis of Class 1 explosion

7.3.2.1 Overpressure consequence

Partial quantitative analysis has been undertaken for the consequence of a detonation at the surface and underground explosives stores by considering the level of damage expected at specific overpressure values provided by HIPAP-4. The maximum overpressure levels off-site anticipated in the event of a detonation at either store has been provided by GSS' calculation of the overpressure radii around the store in accordance with AS 2187.1 1998 – Explosives, Storage, Transport and Use – Storage, as shown in **Figure 6.1** for the Willows Rd site and detailed in **Table 6.3** for the proposed underground store in the WUG. The WUG overpressure levels around the surface connections have been calculated for three vents in the Coromandel Forest Park above the WUG, and two connections on Willows Road. These are considered representative of overpressure levels that would be anticipated for any selected vent location in the designated area.

The predicted overpressure levels at off-site locations are considered in terms of the expected effect provided in Table 7 Appendix 1 of the Hazardous Industry Planning Advisory Paper No.4 (HIPAP-4), Risk Criteria for Land Use Safety Planning, published by the State of New South Wales through the Department of Planning in 2011 This table is copied as **Figure 7.2** below.

Explosion Overpressure	Effect
3.5 kPa (0.5 psi)	• 90% glass breakage • No fatality and very low probability of injury
7 kPa (1 psi)	• Damage to internal partitions and joinery but can be repaired • Probability of injury is 10%. No fatality
14 kPa (2 psi)	• House uninhabitable and badly cracked
21 kPa (3 psi)	• Reinforced structures distort • Storage tanks fail • 20% chance of fatality to a person in a building
35 kPa (5 psi)	• House uninhabitable • Wagons and plants items overturned • Threshold of eardrum damage • 50% chance of fatality for a person in a building and 1 5% chance of fatality for a person in the open
70 kPa (10 psi)	• Threshold of lung damage • 100% chance of fatality for a person in a building or in the open • Complete demolition of houses

Figure 7.2: Effects of explosion overpressure *Source: HIPAP-4*

Overpressure levels below 3.5 kPa are not discussed, and are presumed to be negligible. At 3.5 kPa, most glass is expected to crack or break, but the potential for injury to individuals is described as very low. At 7 kPa, repairable damage to partitions in buildings is anticipated along with a 10% probability of injury. There are no off-site areas exposed to 7 kPa. The injury probability for the maximum off-site over pressure level of 5 kPa is therefore lower than 10% and, were a building to be located within the 2 – 5 kPa area, there may be some repairable damage to buildings in the form of cracked glass or damaged partitions.

A person in the 2 kPa – 5 kPa radius, such as a farmer on the rural property to the southwest of the surface magazine at the Willows Road tunnel portal site or near the stream to the northeast, would be expected to hear a brief audible noise in the range of 160 – 170 dB from the blast overpressure.

At this level, the sound would be likely to cause the person short term pain and ringing in the ears, similar to the effects of standing close range to a firework or shotgun fire.

A person would need to be located less than 5 m from a surface connection shaft above the WUG in the Coromandel Forest Park to experience an overpressure level of more than 2 kPa. The ventilation shafts will be located in remote areas and securely fenced to prevent public access.

With consideration of the level of impact at the maximum overpressure level, the consequence to human health and property of a detonation at either the surface or WUG Class 1 explosives stores proposed is considered minor.

7.3.2.2 Discharges to air from the WUG

Release of the products of combustion from the WUG ventilation shafts from a detonation in the underground Class 1 explosives store has been assessed in the Air Quality Assessment (AQA) in **Appendix H** for the surface connection locations applicable at the time of the 2022 application.

As previously discussed, part the increased scope of the WNP encompasses further exploratory work to determine the optimal surface connection locations. As a consequence, it is expected that up to two return air vents may be located above the WUG in the Coromandel Forest Park. This differs from the assessment in **Appendix H**, which found the worst case emission scenario resulted from release of the explosion gases from the return air rise via forced ventilation (rather than natural ventilation), as discussed further below. The addition of another return air rise would be expected to reduce the volume of explosion gases released from a single point, and therefore further reduce the potential impact on the environment. The results of the AQA (2022) are considered representative of the potential impact from a return air rise located within the Coromandel Forest Park.

The assessment finds that in the event of a detonation, the gaseous products of carbon monoxide (CO), oxides of nitrogen (NO_X) including nitrogen dioxide (NO_2) and small quantity of ammonia (NH_3) will be generated within the WUG. The mine gas dispersal study prepared by Entech (Appendix A to the AQA in **Appendix H**) found that the maximum emission scenario would occur with full mechanical ventilation to the mine, resulting in all the gases venting from the return air rise vent described as Site 5 in this report (and Site 4 in the GSS report attached as **Appendix B**, which did not include the Waihi Portal as Site 1).

In the fully ventilated scenario, Entech determined that all contaminants would be exhausted from the mine via the return air rise in 15 minutes and 40 seconds. The average emission rate calculated for this period was modelled in atmospheric dispersion modelling as the continuous emission rate over 1 hour in order to compare the predicted results with criteria for human health. This will conservatively overstate the quantity of contaminant emitted.

The relevant assessment criteria for emissions of CO, NO_2 and NH_3 are summarised in **Table 7.2** below.

Table 7.2: Assessment criteria for ambient air quality

Contaminant	Averaging period	Concentration ($\mu g/m^3$)	Reference
CO	1-hour	30,000	NZ AAQG
NO_2	1-hour	200	NES_{AQ} / NZ AAQG
NH_3	1-hour	21,000	US EPA AEGL (Level 1)

NES_{AQ} = National Environmental Standards for Air Quality
NZ AAQG = New Zealand Ambient Air Quality Guidelines
USEPA AEGL = United States Environmental Protection Agency Acute Exposure Guideline Levels

The 99.9th percentile value for the modelled ground level concentration (GLC) is compared with the assessment criteria as the maximum GLC in accordance with the Ministry for the Environment's Good Practice Guide for Atmospheric Dispersion Modelling (MfE, 2004) recommendations for short term averaging periods.

Table 7.3: Evaluation of GLCs against assessment criteria – ANFO or booster

Contaminant	Assessment criteria (µg/m³)	Maximum GLC (µg/m³)	Predicted location	Background concentration (µg/m³)	Cumulative GLC (µg/m³)
CO	30,000	816 (2.7% of criterion)	130 m NE of vent	5,000 (16.7% of criterion)	5,816 (19.4% of criterion)
NO_X (as NO_2)	200	59.9 (30% of criterion)	130 m NE of vent	37 (19% of criterion)	96.9 (48% of criterion)
NH3	21,000	1,143 (5.4% of criterion)	130 m NE of vent	0 (0% of criterion)	1,143 (5.4% of criterion)

For the purpose of a conservative assessment, all NO_X produced in the detonation was assumed to convert instantaneously to NO_2. In reality the atmospheric conversion of NO to NO_2 may take some time and be limited by the available ozone levels in the atmosphere.

The contour plot for NO_X is reproduced as **Figure 7.3** below, and illustrates the contour pattern for all contaminants for a return air rise in the Coromandel Forest Park. It shows that the highest GLC occurs approximately 130 m northeast of the ventilation shaft (Site 5 – WUG Return Air #1, location as provided for in 2022). Though it is considered highly unlikely that a person would be located in the most impacted area during both the worst-case meteorological conditions and a failure of controls leading to a complete instantaneous detonation in the Class 1 explosives store, even in this scenario, the level of exposure is well below the assessment criteria for the protection of human health for all identified contaminants.

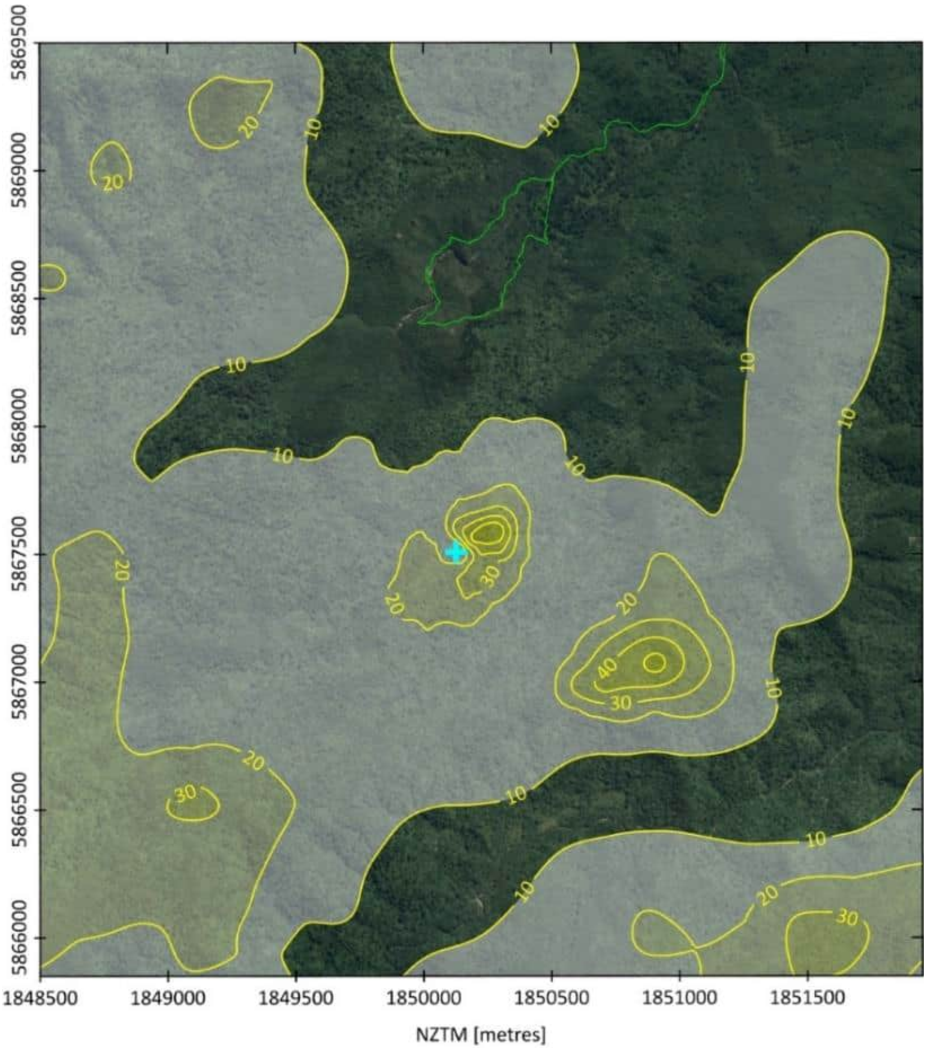

Figure 7.3: Contour plot showing predicted maximum 1-hour average NO_X (as NO_2) concentrations excluding background. Vent location shown as a light blue cross.

The maximum predicted ground level concentrations of contaminants from WUG is expected to be influenced by the surface terrain, but is not anticipated to differ significantly from those shown above for an alternative location.

Overall, given the level of conservatism inherent to modelling of the detonation scenario (i.e. assuming a reduced mine interior volume, complete instantaneous detonation of a full explosive chamber, coinciding with meteorology that causes maximum ground level concentrations and a person located within remote areas of the forest park), the impact to human health from discharge of contaminants from surface vents is very low.

Due to these findings, it is not considered necessary to undertake assessment of discharges to air from the final confirmed surface connection locations.

7.3.2.3 Consideration of known industry events

A detonation in an explosives store managed in accordance with the HSW-HS is considered unlikely. Detonations in Class 1 explosives stores are not common in the mining industry. OGNZL staff note only one known occurrence in the Oceania region, which was a detonation underground in the Telfer Mine in Western Australia in 2005.

The Mines Safety Bulletin detailing the causes and consequence of this detonation is attached as **Appendix I** and summarised as follows

- The detonation occurred in a store that was not designed for high volumes of explosives. It occurred in a "working party magazine", a term for a small temporary store of explosives and detonators (typically <200 kg NEQ) for use by a group working in a particular area in an underground mine. In this case the temporary store was established with more than 6,000 kg NEQ of high explosives and up to 3,000 detonators all in the one chamber. Additionally, the store contained waste packaging debris from the spent explosives, and had been the site of a spill of ANFO in an environment with reactive sulphide-containing minerals.
- When a fire started in the store, it burned for two hours before the detonation occurred. Efforts to put out the fire were hampered by the lack of a water deluge system and fire hoses for fire fighting, the unsuitable class of fire extinguisher available, and inappropriate forced ventilation.
- The consequence of this 6,000 kg class 1 explosive detonation to human life was limited due to timely worker evacuation, however it did cause significant damage to mine underground services, ventilation doors and machinery.

The contributing factors in this event would not lead to a detonation in OGNZL's proposed operation. All stores are designed to meet the standard AS 2187.1. for Explosives Storage Transport and Use, including quantity limits (1,750 kg NEQ in the largest magazine), provision of deluge fire suppression systems, and systems for waste management.

OGNZL has not had any such incidents in any of its existing explosive stores and has a number of additional controls to prevent such an incident. A likelihood rating of "unlikely" is considered appropriate for the event.

Additionally, the long delay (two hours) between ignition of the fire in the Telfer mine working magazine and the detonation of the explosives illustrates how explosives in storage are less volatile than explosives that have been properly prepared and densely packed into a blast hole for mining. This example illustrates that instantaneous and complete detonation of the contents of a magazine is an unlikely scenario.

7.3.3 Risk analysis

A qualitative risk assessment of the identified hazards/failure modes has been undertaken for all of the scenarios identified in the hazard analysis in **Table 7.1** where there is the potential for off-site effects.

The qualitative risk assessment has been carried out in **Appendix J** in accordance with the method described in MfE's Assessment Guide for Hazardous Facilities, by applying a qualitative rating to the frequency (likelihood) of the failure occurring and the consequence (severity) of impacts if the event were to occur. The likelihood and consequence ratings take into account the controls (mitigation and management measures) that will be in place.

The qualitative risk analysis serves as a screening assessment to identify events where the residual risk may be significant and require further quantitative assessment. Where risks are identified that can be managed and are acceptable in terms of a qualitative assessment, no further evaluation is considered necessary. The assessment has been based on information from OGNZL from their own and similar mining operations elsewhere, and professional judgement.

There is one residual risk associated with the proposed activities as identified in **Appendix J Table 4** that was assessed as moderate as follows:

- Moderate residual risk to the ecosystems from a spill of diesel at the SFA or WUG facilities, through a spill during tank refilling or equipment refuelling and low risk from a tank leak, which is managed through physical controls including tank bunding, automatic shut-offs on fuel nozzles, refuelling pad drainage to API separators, maintenance programmes, and management provisions including emergency response planning, spill kits and staff training.

All other residual risks were assessed as low, including:

- Low residual risk to the ecosystems from a spill of diesel from a tank leak or rupture, managed by use of double-skinned tanks which have monitoring systems to identify leaks from the internal tank.
- Low residual risk of fire impacting off-site locations at the oxygen or acetylene storage at the workshop in the SFA, or for the diesel and ANE storage areas at either the SFA or in the WUG. The likelihood of a fire at these storage areas is minimised through prevention measures such as access restrictions, exclusion of ignition sources and segregation of incompatible or reactive substances. The consequence of a fire is minimised by the separation distances to buildings, combustibles and the site boundary at the surface, as well as emergency management measures including fire-fighting facilities and staff emergency response training.
- Low residual risk to ecosystems from a spill of packaged goods such as maintenance oils or gasser during unloading to site or movements to the WUG. This is managed through physical controls including the sealed unloading areas to prevent discharges to the environment and tertiary containment provided by the settling ponds. Small spills are primarily managed through staff training and emergency response planning including spill kits at unloading areas. Storage underground will be in a sealed bunded area. In the event of a spill in transit to the underground storage area, spill response procedures will be followed for containment and clean up. Contact water generated in the tunnel and WUG will be extracted to the surface holding pond before transfer the water treatment plant in Waihi.
- Low residual risk to occupants of off-site properties from an unplanned detonation in the proposed Class 1 explosives storage area at the Willows Road tunnel portal entrance site or the underground Class 1 explosives store in the WUG. The likelihood of this event is minimised through site design, restricted access by externally certified handlers only, storage in certified magazine units with security monitoring systems and lightning strike protection, availability of fire protection systems and emergency response management measures. The consequence of this event is evaluated quantitatively using the calculated overpressure level at off-site locations in Section 7.3.2.1 and determined to be minor. The consequence of a detonation at the surface Class 1 magazine area to off-site people is limited through provision of a large separation distance to incompatible substances and the boundary. In the WUG, the consequence of a detonation is limited by the depth underground that the storage chambers will be located and the remote location of the proposed exhaust vents at the surface.

8 Assessment of effects

8.1 Introduction

The following assessment identifies and assesses the actual and potential effects of the proposed hazardous substances storage and use as part of the development and operation of the Willows Road tunnel portal entrance site and the WUG. This assessment also outlines the measures that OGNZL proposes to avoid, remedy or mitigate any potential adverse effects on the environment.

8.2 Hazardous substances

In accordance with the Objectives and Policies of the HDP, the assessment has also had particular regard to the following aspects:

- Adoption of a low-risk approach and avoiding as far as practicable the risks associated with the production, storage, use, conveyance and disposal of hazardous substances;
- Ensuring that hazardous substances are used, handled and conveyed through the district in such a way to avoid adverse environmental and health effects;
- Discouraging the production of hazardous waste, and avoiding unsafe discharge or disposal of hazardous waste to the environment; and
- Recognition of industry and operator codes of practice.

8.2.1 Effects on people and property

The Willows Road site is situated in the Rural zone, with the mining tunnel extending into the Conservation (Indigenous Forest) zone under the HDP. The risks to people and property are from a fire at the bulk stores of hazardous substances, including the explosives magazines and oxidising agents stored at the surface near the portal and underground in the mine.

Class 1 explosive substances are proposed to be stored in six H.E. magazines and one I.E. magazine at the surface. The same number of individual storage chambers are proposed for the underground store. Each magazine or underground chamber will be separated by an offset distance that mitigates the risk of inter-magazine propagation per industry standard AS 2187.1, Table 3.2.3.1. When considering the consequence of an unintended detonation at the explosive storage areas, overpressure zones have been conservatively estimated by GSS for one H.E. magazine and the I.E. magazine, equivalent to an individual magazine of 1,310 kg NEQ for the surface facility and 1,100 kg NEQ for the underground facility. These overpressure zones enable a quantitative consequence analysis for the impact of an unintended initiation.

As discussed in Section 6.2 for the surface magazine, there are areas of neighbouring rural and conservation land that fall within the 2 kPa blast overpressure radius of the magazine. While there are currently no dwellings in the area of overlap, there are no restrictions on dwellings being established in future on the rural property. Under the HSW-HS regulations, there are no restrictions on buildings with fewer than 4 storeys in the 2 kPa – 9 kPa radius area unless they are being used for hospitals, early childcare centres or vulnerable facilities of similar scale.

Small areas to the north of the Willows Road site in the Conservation (Indigenous Forest) zone also fall within the 2 kPa blast overpressure radius of the surface magazine compound. There are no residential units or public walking tracks in this area, however it is feasible that a person could be present at this location.

In the event of a detonation in the underground explosives storage facility, overpressure is expected to exhaust at up to six surface vent locations as discussed in Section 6.3. All surface vent locations are proposed to be located on either OGNZL owned land or within the Coromandel Forest Park with suitable public access restrictions. The largest overpressure area around any of the vent locations is the 2 kPa zone, within which vulnerable facilities are restricted from being present under the HSW-HS. In previous modelling, this zone extended in the maximum case to 4.7 metres from indicative Site 4, a return air rise immediately above the WUG. The exact location of surface vents in the Forest Park area is yet to be confirmed, and one additional return air rise may be established as part of the WNP. No structures will be permitted at this proximity to the surface vents, and beyond the 2 kPa radius (which extends to 2.5 m beyond the perimeter fence in the maximum case), the overpressure level decreases to a negligible level. Overpressure levels will be calculated for the final confirmed location of the surface connections, and are not expected to differ significantly from those previously assessed.

The New South Wales Department of Planning HIPAP-4 provides the expected effect of various levels of explosion overpressure as reproduced in **Figure 7.2** in Section 7.3.2.1. The injury probability at the 5 kPa boundary is expected to be lower than 10% and the probability of injury will decrease with distance from the boundary. Minor and repairable damage to glass or partitions could be expected on a building near the OGNZL boundary. The off-site risk to people or property within the 2 – 5 kPa radius from an accidental detonation associated with the storage of explosives has been assessed as low.

An AQA provided as **Appendix H** has evaluated the potential impact on human health from discharges of CO, NO_X (as NO_2) and NH_3 at the surface connections in the event of a complete detonation of a Class 1 explosives storage chamber underground. In this scenario, the predicted ground level concentrations within 2 km of the vents comply with the assessment criteria for each contaminant. The maximum contribution to concentrations at the surface is predicted for NO_X, which, cumulative with the background concentration for rural areas, is less than half the 1-hour average National Environmental Standard for Air Quality for NO_2. The maximum cumulative concentration for CO is 2.7% and for NH_3 is 5.4% of the relevant criteria for the protection of human health. The location of this maximum prediction was within in the forested area approximately 130 m from the surface connection and over 800 m from the nearest public walkway. The maximum predicted ground level concentrations of contaminants from WUG are expected to be influenced by the surface terrain, but is not anticipated to differ significantly. Given the high degree of conservatism in the assessment, the effects to people from air discharges from the WUG in the event of an unplanned detonation are less than minor.

The off-site risk to people or property from an accidental detonation associated with the storage of explosives has been assessed as low. The controls in place to mitigate the risk include the appropriate design, testing, certification, operation and maintenance of the explosives magazines or underground chambers in accordance with the HSW-HS requirements (including for security, lightning strike protection), segregated storage areas and loading zones away from other flammable or explosive substances and away from buildings, and an Emergency Management Plan. Workers on site will be trained in emergency response as per the Emergency Management Plan. Likewise, the risk of a fire at the ANE store or diesel storage locations both above and below ground or at the SFA workshop (storage of oxygen and acetylene gases) are appropriately managed through restriction of ignition sources, incompatible materials and access by personnel other than trained workers. The SFA where the oxidisers, acetylene and diesel are stored at the Willows Road site is greater than 180 m from any off-site dwellings.

Taking into consideration the proposed controls to manage the hazards, the isolation of the activity and the separation distance to the closest dwelling, the risk of effects on people or property from an accidental detonation at an explosives store or fire at the oxygen gas, acetylene, ANE or diesel storage locations have been assessed as low. Provided the controls and mitigations are in place as outlined above, the effects on the people and property are expected to be less than minor.

8.2.2 Effects on ecosystems

The risk to ecosystems from a spill to the environment associated with the use and storage of ANFO, packaged explosives/boosters/detonators and ANE has been assessed as low due to the physical properties of the substances, which are respectively: a granular solid, small packaged articles and a highly viscous emulsion. Many of the mechanical oils, greases and their associated waste oils are not classed as hazardous, however all will be stored and used in bunded, sealed areas at the workshop near the portal entrance, or stored underground in a services bay. Gasser does not have an environmental hazard but will likewise be stored in a bunded storage area.

The greatest risk that has been identified which could result in an off-site environmental effect is an accidental release of diesel during delivery by truck to the services bay at the surface or the underground refuelling units, refuelling of the generator or fire pumps at the SFA or during the refilling of the mechanical equipment.

All refuelling activities will be undertaken by trained staff prepared to carry out emergency response measures in the event of a small spill. The diesel refuelling facilities are designed with interlocks to prevent overfilling of the tank or equipment. The refuelling of equipment will be undertaken by trained staff, with access to spill kits for spill response. The areas where diesel and oils are stored and where refuelling takes place are bunded to prevent storm-water ingress and the pads drain to treatment prior to discharge to the environment.

All storage of hazardous substances will also be undertaken in compliance with the HSW-HS requirements which include requirements on separation between materials, secondary containment and certification. All hazardous substances will be transferred to their storage locations within appropriate timeframes of their arrival on site.

Provided the controls and mitigations are in place as outlined above, the effects on the environment are expected to be less than minor.

8.2.3 Cumulative effects

The substances proposed to be stored at the surface with potential for off-site effects are Class 1 explosives at the magazine compound and the Class 5 oxidising substances at the SFA at Willows Rd, the greatest risks being accidental detonation or ignition. The surface infrastructure area is located beyond the 2 kPa overpressure radius of the magazine compound, and is not expected to be impacted by an unintended detonation at this distance. There are no other stores at proximity to the proposed site storing explosive or oxidising substances. Similarly, the underground Class 1 explosives and Class 5 oxidisers are separated by more than 100 m at the shortest distance to minimise the cumulative impacts of an event at either store. The remote locations underground beneath the Coromandel Forest Park provides significant separation to any other hazardous facilities in the area. Each hazardous substance store is managed in accordance with the controls described in Section 4 and the chance of simultaneous failures and cumulative effects is low.

Other chemicals that will be stored on-site with potential for off-site effects are diesel, gasser, oils and greases. The greatest risks being a spill during substance unloading to site or refilling of equipment. Refuelling of drilling equipment at any of the previously established drill sites and water pump locations in the Coromandel Forest Park is the only comparable activity in the vicinity. Each drill site is managed in accordance with the controls described in Section 4 and the chance of simultaneous failures and cumulative effects is negligible.

8.2.4 Transport

Any transport of hazardous substances by road will be in accordance with the Land Transport Rule: Dangerous Goods 2005 and, when on site, all transport of explosives is carried out under the supervision of a Certified Handler. Transport of hazardous substances via helicopter will adhere to the Civil Aviation Rule Part 92 – Carriage of Dangerous Goods.

These measures are considered sufficient to ensure that the environmental effects arising from the transport of hazardous substances will be less than minor.

9 Conclusions

The key risks associated with the proposed storage and use of hazardous substances associated with the Willows Road tunnel portal site and underground in the WUG include:

- The risk to people and property from a fire or detonation at the explosives magazines, ANE storage area, gas storage at the SFA workshop or diesel tanks;
- The risk to ecosystems from a spill of diesel during tank filling or equipment refuelling; and
- The risk to ecosystems from a spill of packaged goods during unloading to site or movement to their designated storage locations in the WUG.

The risks to people and property from an unintended detonation at the proposed explosives storage locations is assessed as low and will be managed through site and equipment design (e.g. separation distances to off-site locations and other explosives stores, provision of fire protection systems and certification of the explosives storage magazines) and management controls (personnel access restrictions, security monitoring, staff training and handler certification, and emergency response plans).

The surrounding areas at the surface at Willows Road and in the Coromandel Forest Park above the WUG are considered sensitive to the effects of an unintended detonation. However, taking into account the proposed controls and distance to sensitive land uses the effects on off-site people and property from the proposed hazardous substances storage has been assessed as less than minor and acceptable.

The final location of surface connections above the WUG cannot be determined without further investigation of ground and hydrogeology conditions, which is sought to be authorised as part of the staged approach to the WNP. The number of proposed surface connections may be up to four above the WUG. The proposed change in location of surface connections does not alter the conclusions of the assessment of effects.

The risks to people, property and the environment from a fire at the surface facilities area of the Willows Road site is low and managed through site and equipment design (e.g. separation of incompatible substances, combustible material and ignition sources and provision of fire-fighting facilities) staff training, and emergency response plans. The proposed hazardous substances storage locations are isolated from public access. Taking into account these controls, the effects on people and property from the use and storage of hazardous substances have been assessed as less than minor and acceptable.

The environment is considered sensitive to the effects of a spill of diesel or spill of packaged goods. The risk to the environment will be managed through the site design (e.g. proposed spill containment measures including double skinned tanks, sealed refuelling areas, bunded storage areas and provision of water treatment for run-off arising from areas where these substances are stored or used) and operational procedures (e.g. spill response plan, unloading and safe handling procedures). Taking into account these controls, the effects on the environment from the use and storage of hazardous substances have been assessed as less than minor and consistent with the HDP objectives and policies for hazardous substances. No additional controls are considered necessary as part of the resource consent.

10 Applicability

This report has been prepared for the exclusive use of our client Oceana Gold (New Zealand) Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that the Fast-track Approvals panel as the consenting authority will use this report for the purpose of assessing that application.

This report has been prepared in accordance our Master Consulting Agreement (OGN 3269) and with the scope of work set out in our letter of engagement dated 21 June 2024 (T+T ref 1015212.3000).

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
....	....
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Appendix A Location assessment – Surface magazine

OCTOBER 20, 2021

WAI-985-000-REP-LC-0034_Final Rev0
TECHNICAL REPORT
WILLOWS ROAD – SURFACE MAGAZINE LOCATION ASSESSMENT
GENERAL AREA 000

WILLOWS ROAD – SURFACE MAGAZINE LOCATION ASSESSMENT

Waihi North Project

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1. Executive Summary

A location assessment for a proposed surface located class 1 storage facility known as the 'Willows Road – Surface Magazine Facility' is the subject of this technical report. The class 1 facility will be utilised for mining operations associated with the 'Wharekirauponga Underground' (WUG) mine.

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017* is the key legislation that must be considered when designing, constructing and licensing a class 1 storage facility. The newly proposed facility would be deemed compliant and suitable for a total capacity of up to 7,360 kg of mixed class1 substances.

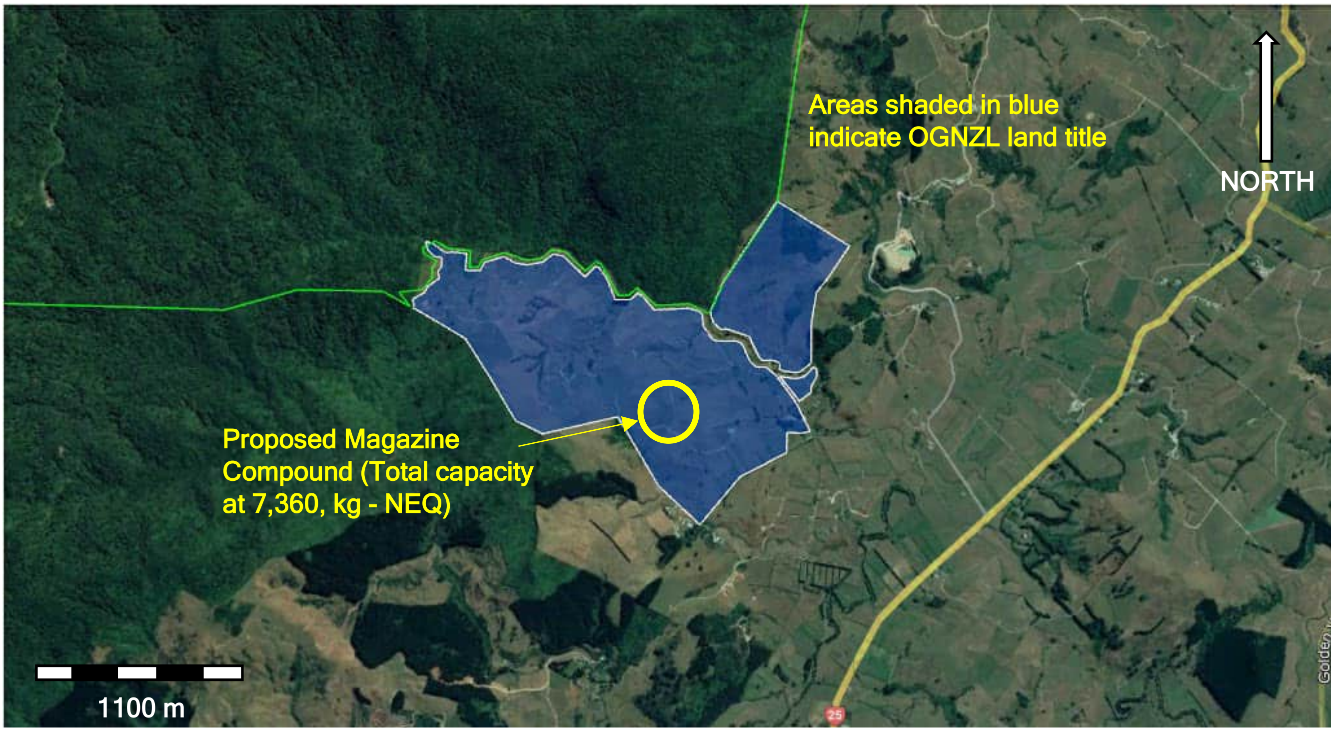
The facility would utilise up to 7 individual magazines to accommodate up to 7,360 kg of class 1 substances to mitigate the requirement for greater overpressure offset distances (controlled zones).

Appropriate offsets distances between magazine units (known as Inter-Magazine Distance or IMD) are established in order to mitigate risk of nearfield propagation between each individual magazine unit. The calculated controlled zones are therefore based upon the stored quantity (Net Explosive Quantity or NEQ in kg) in each of the individual magazines.

The stored substances at the facility would comprise of a variety of commercial explosives products that are commonly used in similar mining operations.

The proposed location of the facility is shown in Figure 1. The assessment of this location considered a number of factors including environmental considerations, operational efficiency and personnel safety. The location and proposed storage quantities are deemed to be compliant with the relevant hazardous substance legislation.

Controlled zone calculations have been based upon TNT equivalence (see definitions), whereby multiple grades and types of commercial explosives may be stored at the location at any given time.



'Figure 1 – Aerial image indicating proposed Willows Road Magazine Facility'

2. Introduction

The current Waihi Gold mining operations have been in production for over 20 years within the township of Waihi, in the eastern Waikato region of New Zealand. The Waihi Operation is owned by Oceana Gold (New Zealand Ltd) (OGNZL). Through the proposed Waihi North Project (WNP), OGNZL seeks to expand the existing operations and extend the life to at least 2036.

The WNP includes the ongoing mining of existing resources as well as the development of new resources. The Wharekirauponga Underground (WUG) mine is one of the new resources proposed to be developed.

The WUG resource is located approximately 10km north of the township of Waihi. The resource lies beneath Department of Conservation (DOC) land within the WKP Minerals Mining Permit (60541) area.

The mining process involves drill and blast operations utilising commercial class 1 explosives. The project has forecast the required quantity of explosives for use in mining operations. These quantities would be delivered to the site by a reputable commercial supplier and stored in certified magazines prior to use in mining operations.

The new class 1 storage facility will be subject to the same legislative requirements and operational management plans as the Oceana Gold's existing facilities that support Martha Underground mining operations. Once licensed and constructed, the new storage facility would be controlled by qualified personnel. The facility will be inspected and re-certified annually, with a 'Location Compliance Certificate' issued. These certificates are issued by independent Compliance Certifiers who are authorised by WorkSafe New Zealand. The facility will be operated in compliance with the *Health and Safety at Work (Hazardous Substances) Regulations 2017*.

Oceana Gold's Waihi Gold mining operations have a demonstrated track record of safely managing stand-alone and fully compliant class 1 storage facilities.

Global Seismic Solutions Ltd (GSS) was engaged by OGNZL to investigate an appropriate location and develop a site design for the class 1 storage facilities at Willows Rd Farm. In addition to complying with legislative requirements, the site design assessment included safety, environmental and operational considerations.

While class 5 substances will also be utilised by WUG mining operations, these are stored separately to class 1 substances and are the subject of another separate report.

3. Regulatory Compliance Considerations for Class 1 Storage Facilities

The *'Health and Safety at Work (Hazardous Substances) Regulations 2017'* is the primary reference document for hazardous substances in the workplace. It references classes 1-9 including 'use, storage, transportation, manufacture and disposal'. The regulation is derived from the overarching '*Health and Safety at Work Act 2015' legislation*.

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017'* outlines the compliance requirements and regulations regarding controlled zones and obligations of a 'Person Conducting a Business or Undertaking' or PCBU (refer to *Section 9.27*).

A *controlled zone* means:

'An area abutting a hazardous substance location that is regulated so that', —

> *(a) within the zone, the adverse effects of a hazardous substance are reduced or prevented; and*
>
> *(b) beyond the zone, members of the public are provided with reasonable protection from those adverse effects*

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017'* also stipulates additional requirements of a PCBU in relation to mitigating risk from storage of class 1 substances including emergency response and requirements for competent person(s) to be in charge of such substances.

Additional reference documentation, '*AS 2187.1 1998 – Explosives, Storage, Transport and Use – Storage'* has been considered in the assessment of a suitable location. This legislation provides guidance in relation to suitable Inter Magazine Distances or IMD, which supports the calculation of controlled zones using the NEQ of individual magazine units.

Table 3.2.3.2 of *AS 2187* describes the offset distances to 'other explosive storage'. This table was utilised to support the separation distances between individual magazine units in relation to mitigating propagation risk. The use of bunding between individual magazine units in accordance with *AS 2187.1 - Table 3.2.3.2*. has been considered when determining the IMD.

Appendix B of the *AS 2187.1 – Appendix B'* describes the bund design requirements and construction methodologies to support the reduced IMD offsets.

The 'QD co-efficient formulae' found in the *'International Ammunition Technical Guideline (IATG 2.20) – Quantity and Separation Distances, part 6.1.2 – inter-magazine distances (IMD)*, *Table 8: Effects and impact of QD for HD 1.1' or 'Annex C, D and E'* has been considered in relation to propagation between individual magazines within an explosives compound.

3.1 Location Compliance Certification

Sections *'r.6.23 and r.9.26'* of the '*Health and Safety at Work (Hazardous Substances) Regulations 2017* describe the requirements for certification of a site containing hazardous substances, namely 'class 1 explosives'.

The 'Willows Road – Surface Magazine Facility', would be a new facility at a separate location to any of the other OGNZL class 1 storage facilities. As such, it has been assessed as a standalone site against the relevant legislation.

The certification process for a site that will store hazardous substances must consider the regulatory requirements described in sections '*r 9.11, 9.12, 9.13, 9.14, 9.15* and *9.16* 'as well as appropriate emergency response and administrative controls.

In addition to the compliance certification process, notification shall be given to Worksafe New Zealand in accordance with '*r 9.22 (4) of HSW (Hazardous Substances) Regulations 2017'.* This notice must be provided at least 30 working days prior to the commissioning of the hazardous substance storage facility.

3.2 Other Design and Storage Considerations

Site design must also consider the obligations for the storage of class 1 substances described in '*Part 9 of HSW (Hazardous Substances) Regulations 2017*. The types of considerations are outlined below.

- 5 yearly magazine structure design and certification *(r 9.20)*. *AS 2187.1* for build specification.
- Site security requirements such as fencing and/or perimeter motion sensor (if deemed necessary).
- Signage requirements.
- Emergency response and evacuation including engagement with FENZ.
- Earthing requirements and protection from lightning strike.
- Qualification, training and competence for handlers of class 1 substances.
- Mounding requirements ('*Table 3.2.3.2'* and '*Appendix B'* of '*AS 2187.1'*).

Further administrative and personnel obligations are described in *Parts 1-8, HSW (Hazardous Substances) Regulations 2017.* These must be considered in the final site design process as well as the management plans under which the site will be operated.

4. 'Willows Road – Surface Magazine Facility' Overview

As part of the process to identify a suitable location for a class 1 storage facility the below key elements were considered.

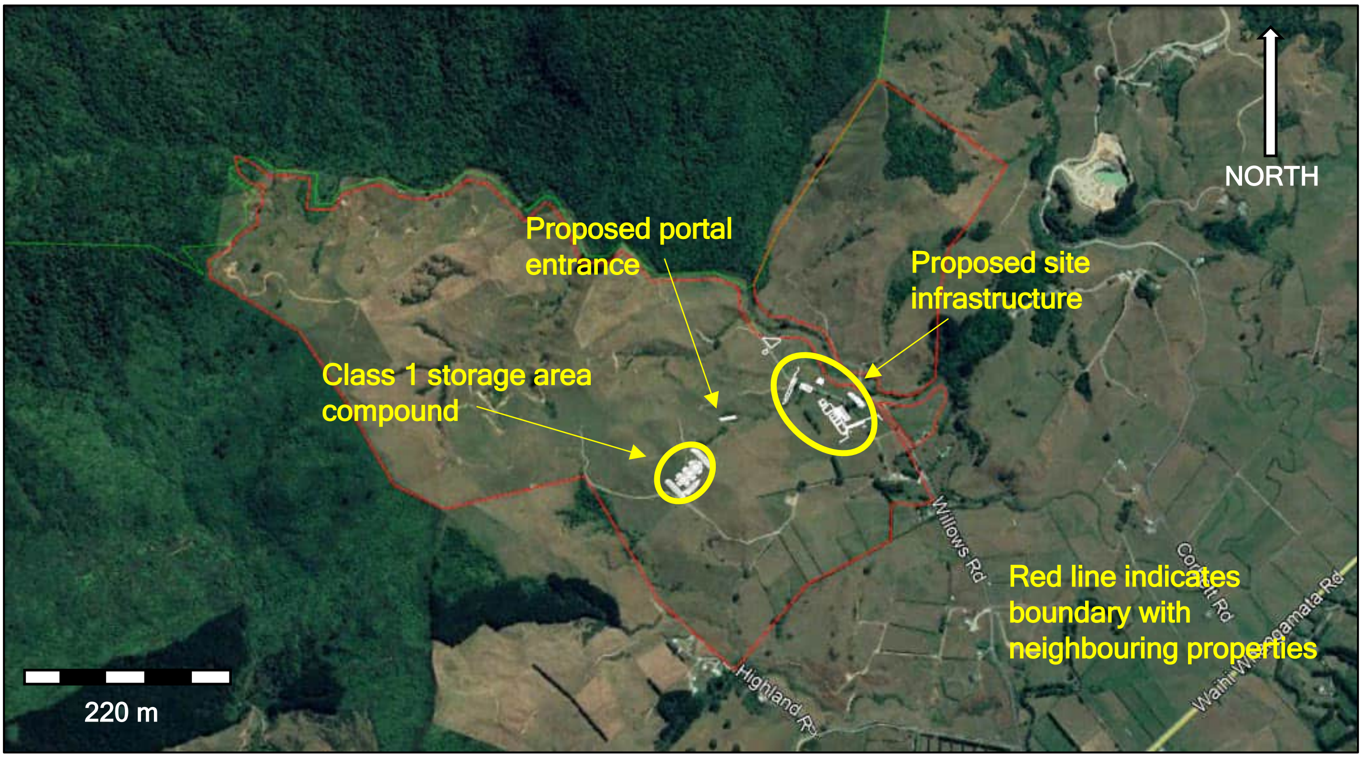
- Compliance with '*HSW (Hazardous Substances) Regulations 2017*, including achieving appropriate controlled zone offsets in relation to required capacities.
- Limited environmental impact.
- Minimising potential impacts on neighbouring properties.
- Mine production forecasts and quantities of class 1 substances required.
- Minimising the number of deliveries to site to reduce the frequency of transport of class 1 substances on public roads.

Potential storage locations also considered operational and civil requirements including potential earthworks, location in proximity to active mining areas, roads, firebreak offsets and topography.

After investigating a number of potential sites, a singular location that incorporated the relevant design criteria to align and comply with '*HSW (Hazardous Substances) Regulations 2017'* was identified. The proposed site was selected based on the previously mentioned criteria. The site underwent extensive review and is considered the most appropriate from both regulatory and operability perspective. The selected location is positioned in a remote part of the proposed property. The site has the below key benefits.

- Compliant in respect of controlled zones for the proposed storage quantities (NEQ - kg)
- Minimal environmental impacts.
- The storage site is separated from and located at a distance to the centres of proposed mining activities (including the proposed mine infrastructure area).
- Securing the site will be a straight forward process.
- Limited visual exposure to surrounding district.
- Remote location with sufficient offsets in respect of controlled zones.
- Adequate space to construct the required mounding between individual magazines.

Figure 2 (overleaf) shows the location of the proposed class 1 storage area in relation other site infrastructure.



'Figure 2 - Site layout'

4.1. Operational and Product Storage Capacity Requirements

Project consumption forecasts estimate that stored quantities of approximately 7,360 kg will be required. It is forecast that restocking of class 1 substances will be required on a weekly basis. During peak usage periods, a more frequent replenishment program may be required.

The proposed storage would typically consist of up to approximately 10,000 detonators (I.E – 10 kg NEQ), and an aggregate quantity of up to ~7,350 kg NEQ of High Explosives (H.E). The stored H.E component would comprise varying commercial explosive substances based on operational requirements.

Depending upon operational mining conditions, the mining process will utilise an ammonium nitrate-based emulsion product (A.N.E) as the bulk explosive component. This would be stored on site as a 'class 5 substance' at a separate and approved location. This class 5 substance is sensitised during loading operations to become a class 1 explosive. This strategy would reduce the reliance on storing larger quantities of bulk commercial explosive products on site. A separate independent report has been prepared for class 5 storage.

4.2. Controlled Zone Considerations

Part 9. r. 9.27 of the '*HSW (Hazardous Substances) Regulations 2017'* explain that the *'PCBU is to control adverse effects of unintended initiation'.* One method of achieving compliance with this section of the regulations is by way of managing the 'controlled zones'.

There are varying 'overpressure' *(kPa)* threshold criteria (Section *'r 9.27'*) applied to class 1 locations that relate to the different controlled zones. The overpressure thresholds are proportional to the stored NEQ. The potential effects on nearby infrastructure/ buildings/personnel in the event of an unintended detonation are considered when determining stored NEQ.

In addition to managing controlled zones, evacuation zones may be an appropriate means of achieving compliance with regulatory requirements by limiting risk exposure to people (by way of 'hazardous fragments/ m^2'). The determination of evacuation zones and a Trigger Action Response Plan (TARP) form part of the site's operational Emergency Response Plan (ERP).

Threshold overpressure management is effected in one of two ways. That is, either by total NEQ stored, or by altering the distance of the storage location in relation to infrastructure, buildings or personnel.

Controlled zone offset requirements have been derived from calculations considering '*TNT Equivalence*' as the donor explosive, referencing *'International Ammunition Technical Guideline (IATG 1.80) - Formulae for Ammunition Management', Part 6.2.1, Table 9a, Kingery and Bulmash - Polynomial for Incident Pressure (Hemi-Spherical Surface).* and '*Part 5 Table 1: Hopkinson-Cranz Scaling Law*'

Refer to '*TNT Equivalence*' in 'Terms and Definitions'.

Controlled zone offset requirements have been based on the greatest offset distance in relation to the stored NEQ specific to each individual magazine within the class 1 storage facility A total controlled zone contour has been developed. This is an aggregate of all of the controlled zones associated with each individual magazine unit.

Where I.E magazines are positioned within minimum IMD for 'other explosives storage' as per '*Table 3.2.3.2* of *AS 2187.1*', the aggregate NEQ for relevant H.E and I.E magazines is used to calculate the controlled zone area.

Whilst the I.E magazine positioning may be altered to suit operational needs, the offset distance between I.E and H.E magazines is to be maintained in accordance with '*Table 3.2.3.1*' of '*AS 2187.1*'.

4.3. Controlled Zone Considerations in Relation to Regulatory Thresholds

The paragraphs below outline the regulatory definitions for each of the controlled zones and how the proposed class 1 storage location will achieve the necessary compliance.

Controlled zone definition – 24 kPa

r 9.27(4)(a) *– A PCBU with management or control of a hazardous substance location that is used solely for securing and holding a class 1 substance must limit the quantities of any class 1 substance at the location to ensure that, in the event of an unintended initiation, -*

i. the interior of any proximate building where a class 1 substance is manufactured would not be subject to a blast overpressure of more than ***24 kPa.***

Formula for minimum offset distance in accordance with the above criteria - $D = 7.2Q^{1/3}$

Proposed class 1 site - Compliance summary.

- This is currently not applicable as the manufacture of class 1 substances on site is not being considered at present.
- Where manufacture may be considered using A.N (Ammonium Nitrate), '*Table 3.2.3.2*', *Associated Works*' of '*AS 2187.1*', 'applies in relation to minimum offsets to 'A.N storage.
- Controlled zone offsets shall be considered if manufacture does occur.

Controlled zone definition – 13 kPa

r 9.27(2)(a)(i) *- public traffic routes of low density and places where people may occasionally be present in numbers up to 200 persons on average in any 24-hour period are not subject to any of the following:*

i. a blast overpressure more than ***13 kPa.***

Formula for minimum offset distance in accordance with the above criteria – $D = 11.2Q^{1/3}$

Proposed class 1 site - Compliance summary.

- This applies to any person in a public or private place within this zone irrespective of number or density.
- In the event of an emergency situation, all site personnel within this zone shall evacuate to 5 kPa zone (minimum).
- The 13 kPa controlled zone does not cross into public or private space.
- The zone will be managed by way of OGNZL ERP and appropriate evacuation.

Controlled zone definition – 9 kPa.

***r 9.27(2)(b)(i)* -** *public traffic routes of medium density, places where people may occasionally be present in numbers up to 900 persons on average in any 24- hour period, and the interior of any proximate building within the boundary of the place where people not directly handling explosive substances are present are not subject to any of the following:*

*i. a blast overpressure more than **9 kPa**.*

Formula for minimum offset distance in accordance with the above criteria – $D = 14.8Q^{1/3}$

Proposed class 1 site - Compliance summary.

- This applies to public traffic routes of medium density which are not present on the site.
- Applies to the interior of any proximate building on site not related to handling of explosives (e.g., office, lunch room etc.).
- The zone will be managed by way of an appropriate OGNZL ERP including evacuation protocols.
- The controlled zone does not cross into any public or private space.
- There is no exposure to any 'un-related' occupied building within the controlled zone.

Controlled zone definition – 5 kPa

r 9.27(2)(c)(i) *- public traffic routes of high density, areas of high intensity land use, or any area where a person may be legally present inside the boundary of the place where the hazardous substance location is located are not subject to any of the following:*

*i. a blast overpressure more than **5 kPa.***

Formula for minimum offset distance in accordance with the above criteria – $D = 22.2Q^{1/3}$

Proposed class 1 site - Compliance summary.

- Applies to any person legally inside boundary of OGNZL owned land, whether employees or members of the public irrespective of number or density.
- Managed by way of OGNZL ERP and evacuation (e.g., Muster location must be outside this area).
- The controlled zone does not cross into any public high density traffic routes or area of high intensity land use.

Controlled zone definition – 2 kPa.

r 9.27(2)(d) *- vulnerable facilities are not subject to more than a blast overpressure of **2 kPa.***

Formula for minimum offset distance in accordance with the above criteria – $D = 44.4Q^{1/3}$

Proposed class 1 site - Compliance summary.

- The 2 kPa controlled zone does cross into neighbouring property. However, at the time of writing no 'vulnerable facilities' exist within this zone and site would be fully compliant.
- Should a vulnerable facility be constructed within the 2 kPa zone on the neighbouring property, OGNZL will either need to adjust the storage capacity or relocate the storage facility.

Table 1 summarises the minimum offset distances for the proposed H.E and I.E magazines.

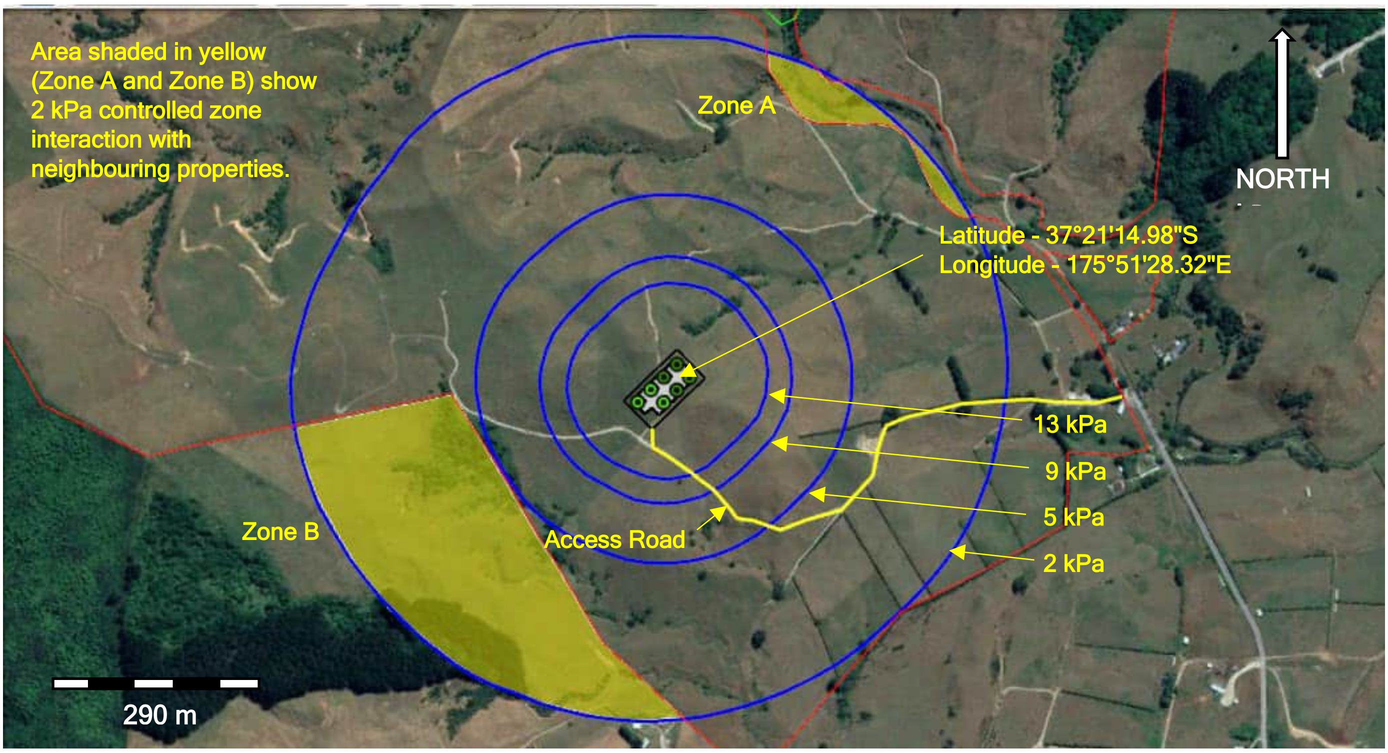
<u>The offset distances are based upon the use of mounding between individual magazine units and that the IMD is based on the mounded offsets described in</u> '*Table 3.2.3.2*' of '*AS 2187.1*'.

Magazine ID and Maximum Stored Quantity	Min. Offset Distance *2 kPa*	Min. Offset Distance *5 kPa*	Min. Offset Distance 9 kPa	Min. Offset Distance *13 kPa*	Min. Offset Distance *24 kPa*
H.E1 1,150 kg NEQ	465 m	233 m	155 m	117 m	75 m
H.E 2 1,150 kg NEQ	465 m	233 m	155 m	117 m	75 m
H.E 3 1,150 Kg NEQ	465 m	233 m	155 m	117 m	75 m
H.E 4 1,300 kg NEQ	485 m	242 m	162 m	122 m	79 m
H.E 5 1,300 Kg NEQ	485 m	242 m	162 m	122 m	79 m
H.E 6 1,300 kg NEQ	485 m	242 m	162 m	122 m	79 m
I.E 1 10 kg NEQ	96 m	48 m	32 m	24 m	16 m

'Table 1 - Controlled zone offset table specific to each magazine and proposed stored NEQ'

Where I.E magazines are positioned within minimum IMD for 'other explosives storage' as per '*Table 3.2.3.2* of *AS 2187.1*', the aggregate NEQ for relevant H.E and I.E magazines is used to calculate the controlled zone area.

Figure 3 shows the proposed class 1 storage facility layout including the positioning of individual magazine units. The controlled zones shown in figure 3 are a representation of the aggregate of the controlled zones for each of the individual magazine units. Figure 4 provides a more detailed view of the class 1 storage facility including details of individual magazine storage capacities.



'Figure 3 - Class 1 storage facility with controlled zone areas'

Zone A in Figure 3 shows a typical 'riparian reserve'. It does not have any affected structures or locations relevant to a 2 kPa controlled zone. Zone B represents a private land holding utilised for the purposes of low-density pastoral grazing. This does not have any affected structures or locations relevant to a 2 kPa controlled zone.

4.4. Proposed Magazine Facility Layout and Site Detail

The proposed storage quantities for each individual magazine are designed to ensure controlled zone offsets comply and consider sufficient IMD (inclusive of mounding).

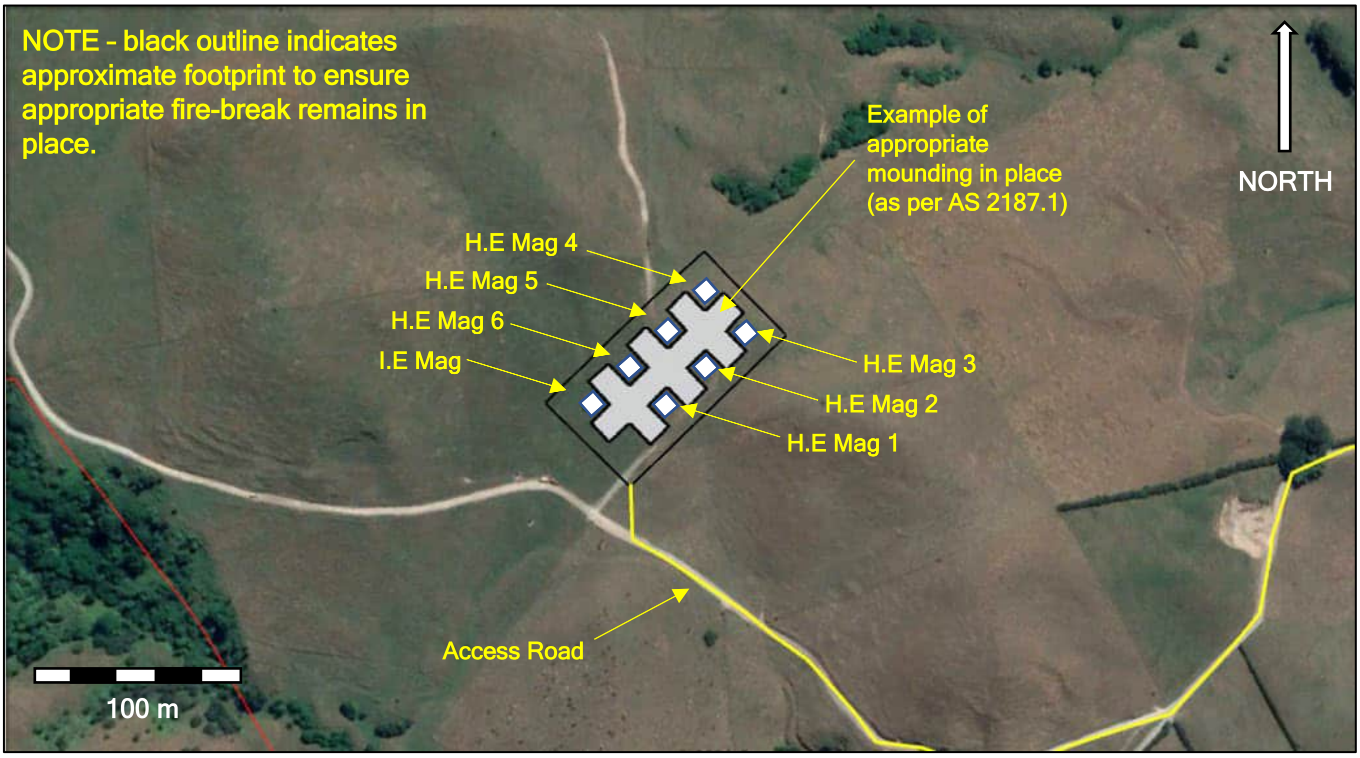
Prior to construction of the class 1 storage facility, a Compliance Certifier will revisit the design to confirm the offset criteria are unchanged in relation to proposed magazine locations. This will confirm the final NEQ to be stored in each magazine.

Adopting the mounded separation distances described in '*AS 2187.1, Table 3.2.3.2*', a minimum 'separation distance to other explosives storage (IMD)' of **27 m** shall be applied. Appropriate mounding must be in place between individual magazine units to mitigate risk of propagation.

Mounding shall be undertaken in accordance with '*AS 2187.1 Appendix B*' to ensure IMD can be maintained and mitigate risk of propagation.

Figure 4 shows the class 1 storage facility layout including the positioning of each individual H.E and I.E magazine and the calculated NEQ. These are also summarised below.

- H.E Magazine 1 – 1,150 kg (NEQ)
- H.E Magazine 2 – 1,150 kg (NEQ)
- H.E Magazine 3 – 1,150 kg (NEQ)
- H.E Magazine 4 – 1,300 kg (NEQ)
- H.E Magazine 5 – 1,300 kg (NEQ)
- H.E Magazine 6 – 1,300 kg (NEQ)
- I.E Magazine – up to 10,000 detonators (10 kg NEQ)



'Figure 4 - Proposed class 1 storage facility layout'.

Appropriate separation distances between H.E and I.E storage must be maintained in accordance with *'Table 3.2.3.1 of AS 2187.1'*. For the proposed storage of 10,000 detonators (10 kg NEQ of I.E), a minimum offset of **3.5 m** (mounded) or **10 m** un-mounded shall be maintained.

5. Conclusion and Summary

The proposed location for the class 1 storage facility is considered compliant with the controlled zone offset requirements described in *' r 9.27, HSW (Hazardous Substances) Regulations 2017'*.

In respect of controlled zones and site personnel, this can be managed with the development of an effective emergency response plan for the storage area.

The storage facility is positioned in a remote part of the site and is separated by an appropriate distance from proposed operational facilities and project infrastructure.

Existing topography at the proposed location appears suitable for a class 1 storage facility. A moderate amount of earthworks will be required to establish the site including the mounding between magazine units. An existing farm track would be upgraded to access the facility.

Two areas are identified where a controlled zone (2 kPa) crosses the boundary; to the north east, and to the south west. This controlled zone relates to *'vulnerable facilities'*. At this point in time no such facilities exist at either location. It is understood the local government zoning does not currently permit the construction of such facilities at either location.

Controlled zones (5 kPa or greater) that may have a potential impact on neighbouring properties, including residential dwellings, have been designed to remain within OGNZL land ensuring the site is fully compliant in that respect.

Provided all other conditions of a 'Location Compliance Certificate' are assessed as satisfactory by an independent Compliance Certifier at the time of construction, the proposed class 1 storage location is considered appropriate in its positioning and proposed capacities.

Reported compiled and submitted – October 20th 2021

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TERMS AND DEFINITIONS

Area of high intensity land use - In relation to an area beyond the boundary of a place where a hazardous substance location is situated, includes an area of *regular habitation*, any other hazardous substance location, and a high-density traffic route

AS 2187.1 – Australian Standard 2187.1-1998, Explosives – Storage, Transport and Use – Storage'.

A.N – Ammonium Nitrate (class 5). Used in manufacture of bulk commercial explosives.

Certified Handler – Person authorised by Worksafe NZ to handle explosives.

Compliance Certifier – Independent person authorised by Worksafe NZ to certify, among other items hazardous substance locations and storage containers to ensure compliance with the New Zealand Regulatory Framework.

Compliance Certificate (Location) – A certificate issued under *HSW (Hazardous Substances) Regulations 2017* to allow storage of specific hazardous substances at a location.

Controlled Zone – An area abutting a hazardous substance location that is regulated in order to protect both site personnel and members of the public, in addition to infrastructure.

E.P – Emulsion Phase. Emulsion solution made from ammonium nitrate (A.N) used as a base for commercial bulk explosives.

E.R.P – Emergency Response Plan. A set of written procedures for dealing with emergencies that minimize the impact of the event.

E.S – Exposed Site. Relates to infrastructure at distance from the proposed storage location.

HSW (Hazardous Substances) Regulations 2017 – Primary governing regulations for hazardous substances use. '*HSW'* meaning '*Health and Safety at Work*.

H.E – High Explosives. Relates to commercial explosive products such as cast boosters, detonating cord, and packaged emulsions. While sometimes referred to as a 'blasting agent', ANFO is also included within the storage classification and for the purpose of this report will be referenced as H.E and may be stored together with all other H.E.

I.E – Initiating Explosives. Relates to products such as detonators used for initiation of 'secondary' type explosive substances.

I.M.D – Inter-Magazine Distance. Describes the distance between individual magazine units storing class 1 explosives. Minimum threshold distances are required in order to mitigate risk of 'inter magazine propagation', (Distance may be reduced with addition of appropriate mounding).

Magazine – Storage container used for securing for class 1 explosives. Generally, of steel construction and built to a specific standard that requires certification.

Mounding – Often referred to as 'Bunding', and is used for protection of PES or ES by way of positioning a barrier at an appropriate location. See '*AS 2187.1, Appendix B* 'for detail.

N.E.Q – Net Explosive Quantity. Used to evaluate the total net explosive quantity (kg) excluding packaging.

Offsets – A known separation distance required by regulations in order to comply – usually referring to the distance between a hazardous substance to people, places, infrastructure or specific features.

Overpressure – Relates to higher than standard atmospheric pressure relating to the effects on personnel and or buildings/ infrastructure. Measured in 'kilopascals' (kPa).

P.E.S – Potential Explosion Site. Relates to magazine locations.

P.C.B.U – Person Conducting a Business or Undertaking.

Propagation – In relation to 'inter-magazine' propagation; in the instance a singular magazine may detonate, the neighbouring magazine would also then detonate due to close proximity to each other.

Sensitiser – Substance added to class 5 E.P to form class 1 bulk explosive.

T.A.R.P - Trigger Action Response Plan, Defines the minimum set of actions required by workers in response to a deviation from normal working conditions, such as an accident or incident.

TNT Equivalence – A normalisation technique where a standardised unit of measurement is used in predicting overpressures for class 1 storage facilities.

The majority of overpressure and impulse equations predict against the effects of TNT, and it is therefore desirable to convert the explosive mass into equivalent TNT charge mass.

Vulnerable Facility – Sensitive building of high construction made from specific materials, or specific buildings associated with aged care facilities, hospitals, education facilities.

Additionally – public buildings/ structures of historic nature or public utilities whose service could be disrupted by a blast of 5 kPa.

REFERENCE A – Legislative Framework within New Zealand

i. *Health and Safety at Work Act 2015*
ii. *Health and Safety at Work Act (Hazardous Substances) Regulations 2017*
iii. *Health and Safety at Work General Risk and Workplace Management Regulations 2016*

REFERENCE B – Supporting Standards and Guidance

i. *IATG 01.80 – 'International Ammunition Technical Guideline - Formulae for Ammunition Management' (Feb 2015).*
ii. *IATG 02.20 - 'International Ammunition Technical Guideline - Quantity and Separation Distances' (Feb 2015).*
iii. *AS 2187.1 – 1998, Explosives – Storage, Transport and Use, Part 1: Storage.*

REFERENCE C – Formulae and Scaling Law for Controlled Zone Calculations

i. *Charles N Kingery and Gerald Bulmash. Airblast Parameters from TNT Spherical Air Burst and Hemispherical Surface Burst, US Technical Report ARBRL-TR-02555. Ballistics Research Laboratory, Aberdeen Proving Ground, Maryland, USA. April 1984.*
ii. *6 Hopkinson B, UK Ordnance Board Minutes 13565, 1915. 7 Cranz C, Lehrbuch der Ballistik, Springer-Verlag, Berlin, 1916.*

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Appendix B Location assessment – Underground magazine

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TECHNICAL REPORT
WHAREKIRAUPONGA UNDERGROUND (WUG) CLASS 1 STORAGE ASSESSMENT
GENERAL AREA 000

This document has been produced for New Zealand consenting purposes only. Information contained herein must not be relied on for investment purposes.

WHAREKIRAUPONGA UNDERGROUND MINE (WUG) CLASS 1 UNDERGROUND STORAGE ASSESSMENT

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1. Executive Summary

A location assessment for a proposed underground class 1 storage facility known as the 'WUG Underground Magazine Facility' is the subject of this technical report. The class 1 facility will be utilised for mining operations associated with the 'Wharekirauponga Underground Mine' (WUG).

Initial development and mining operations associated with the WUG, will be supported by a proposed surface magazine facility known as 'Willows Road – Surface Magazine Facility'. The initial surface magazine facility will be developed as part of the Waihi North Project (WNP).

The underground storage facility is intended to be commissioned at a later stage in mine development (approximately four years after the underground portal is constructed). The proposed facility will be located in a low traffic area of the mine within a series of dedicated and purpose-built chambers.

On establishment, the WUG class 1 underground magazine facility will be utilised concurrently with the WUG surface magazine facility and be treated as a stand-alone location with the same management requirements as other storage facilities. It would be commissioned and certified by an Independent Compliance Certifier as a separate compliant location to other class 1 facilities within the Waihi Gold operations.

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017*' is the key legislation that must be considered when designing, constructing and licensing a class 1 storage facility. However, there is limited specific criteria and guidelines within these regulations relating to underground storage facilities. As such, alternate recognised standards have also been consulted with various relevant elements being adopted to complete the assessment.

Use of a range of alternate recognised standards has allowed calculation of expected surface overpressures (kPa) at varying surface connections in relation to stored capacities and the internal tunnel and magazine chamber volumes within the underground operation.

Appropriate interval distances between magazine chambers (known as Inter-Magazine Distance or IMD) are established in order to mitigate risk of propagation between each individual magazine chamber. The calculated controlled zones at surface are therefore based upon the stored quantity (Net Explosive Quantity or NEQ in kg) in each of the individual magazine chambers.

The proposed facility will utilise up to seven individual magazine chambers. Six of the chambers will store up to 1,000 kg (Net Explosive Quantity (NEQ)) of High Explosives (H.E), one chamber will be used for storage of Initiating Explosives (I.E) with a capacity of up to 100,000 detonators (100 kg - NEQ). The underground facility would be suitable for a total storage capacity of up to 6,100 kg (NEQ).

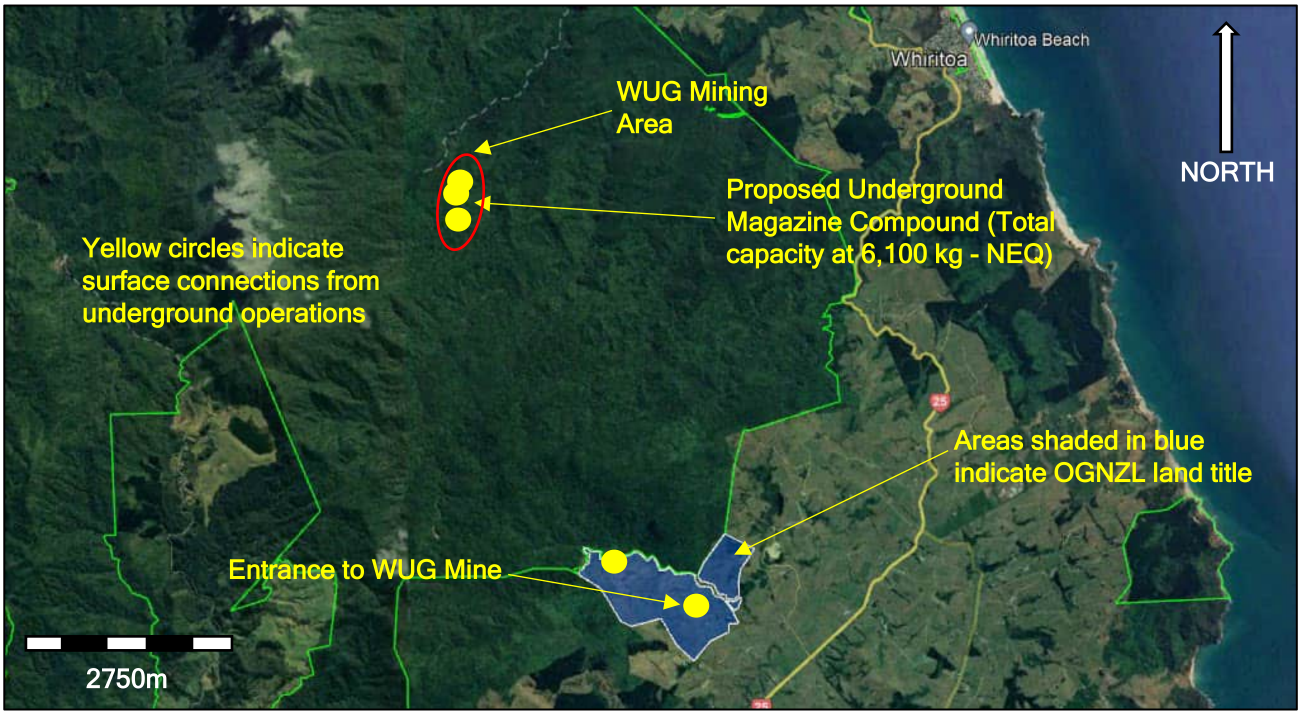
The stored substances at the facility would comprise of a variety of commercial explosives products that are commonly used in similar mining operations.

The proposed location of the facility is shown in Figure 1. The assessment of this location considered a number of factors including operational efficiency, personnel safety and potential effects at surface connections.

Controlled zone offset distances are measured from the outer perimeter of the underground portal and ventilation shafts.

Surface connections identified as 'Sites P0 and P1' to the South are located on OGNZL owned property. Sites identified as 'P2, P3 and P4' to the North are located within Hauraki District Council (HDC) paper road.

Controlled zone calculations have been based upon TNT equivalence (see definitions), whereby multiple grades and types of commercial explosives may be stored at the location within each underground storage chamber at any given time.



'Figure 1 - Aerial image indicating proposed WUG magazine facility'.

2. Introduction

The current Waihi Gold mining operations have been in production for over 20 years within the township of Waihi, in the Eastern Waikato region of New Zealand. The Waihi Operation is owned by Oceana Gold New Zealand Ltd (OGNZL). Through the proposed Waihi North Project (WNP), OGNZL seeks to expand the existing operations and extend the project life to at least 2036.

The WNP includes the ongoing mining of existing resources as well as the development of new resources. The Wharekirauponga Underground (WUG) mine is one of the new resources proposed to be developed.

The WUG resource is located approximately 10km North of the township of Waihi. The resource lies beneath Department of Conservation (DOC) land within the WKP Minerals Mining Permit (60541) area.

The mining process involves drill and blast operations utilising commercial class 1 explosives. The project has estimated the required quantity of explosives for use in mining operations. These quantities would be delivered to the site by a reputable commercial supplier and stored in a certified surface or underground storage facility prior to use in mining operations.

The proposed class 1 underground storage facility will be subject to the same legislative requirements and operational management plans as Oceana Gold's existing facilities that support Martha Underground mining operations. The storage facility would be controlled by qualified personnel.

Upon initial commissioning and certification - the facility will be inspected and re-certified annually, with a 'Location Compliance Certificate' (LCC) issued. These certificates are issued by independent Compliance Certifiers who are authorised by WorkSafe New Zealand. The facility will be operated in compliance with the *Health and Safety at Work (Hazardous Substances) Regulations 2017*.

Oceana Gold's Waihi Gold mining operations have a demonstrated track record of safely managing stand-alone and fully compliant class 1 storage facilities.

Global Seismic Solutions Ltd (GSS) was engaged by OGNZL to investigate an appropriate location and develop a site design for the class 1 storage facilities at WUG. In addition to legislative requirements, the site design assessment included safety, environmental and operational considerations.

While class 5 substances will also be utilised by WUG mining operations, these are stored separately to class 1 substances and are the subject of another separate report.

3. Regulatory Compliance Considerations

The *'Health and Safety at Work (Hazardous Substances) Regulations 2017'* is the primary regulatory document for hazardous substances in the workplace. It references classes 1-9 including 'use, storage, transportation, manufacture and disposal'. The regulation is derived from the overarching '*Health and Safety at Work Act 2015'.*

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017'* outlines the compliance requirements and regulations regarding controlled zones and obligations of a 'Person Conducting a Business or Undertaking' or PCBU (refer to *Section 9.27*).

A controlled zone means:

'An area abutting a hazardous substance location that is regulated so that', —

> *(a) within the zone, the adverse effects of a hazardous substance are reduced or prevented; and*
>
> *(b) beyond the zone, members of the public are provided with reasonable protection from those adverse effects*

In respect of compliance with *r 9.27*, each surface connection from underground mining operations (ventilation shaft/ escape way/ primary access route) must be taken into consideration as an area in which blast over pressure may potentially vent from the underground operations in the event of an unintended detonation.

New Zealand Regulations do not provide for specific direction in calculating such occurrences, however, in referencing '*Annex M'* of *'International Ammunition Technical Guideline (IATG 2.20) Quantity and Separation Distances, Hazard division QD matrix for HD 1.1, (underground storage) 'Table M.1',* such controlled zones can be estimated.

Additional regulatory guidance that has been referenced in the assessment including:

- *International Ammunition Technical Guideline (IATG 1.80), 'Formulae for Ammunition Management (United Nations - Safer Guard) (2nd Edition 01.02.2015);*
- *International Ammunition Technical Guideline (IATG 2.20), 'Quantity and Separation Distances (United Nations - Safer Guard) (2nd Edition 01.02.2015); and,*
- *AS 2187.1 – Explosives – Storage, Transport and Use, Part 1; Storage.*

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017'* also stipulates additional requirements of a PCBU in relation to mitigating risk from storage of class 1 substances including emergency response and requirements for competent person(s) to be in charge of such substances.

4. Proposed WUG Magazine Layout and Positioning

The proposed magazine layout will consist of seven individual magazine chambers within the facility. Six of the chambers will be used for varying commercial High Explosives (H.E) and the remaining chamber will be used for the storage of Initiating Explosives (I.E).

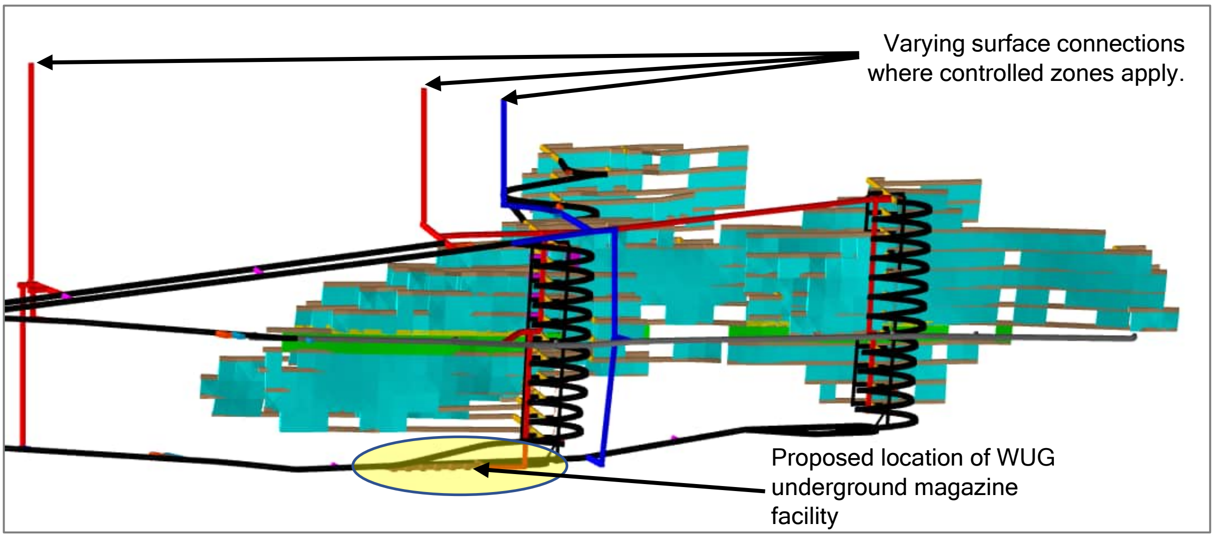
Appropriate separation distances have been considered (as per '*ANNEX M' of IATG 2.20*) between each explosive magazine/chamber, in order to mitigate risk of propagation by both potential rock spall and heat/ gas in the event of an unintended detonation.

Each magazine chamber is estimated to have an internal volume of ~627m^3. The total internal volume for the storage facility, including all magazine chambers and accessway, is ~6,089m^3. This volume is considered during surface controlled zone calculations in the event of an unintended detonation.

Figure 2 shows the underground magazine location set against the proposed mining plan.

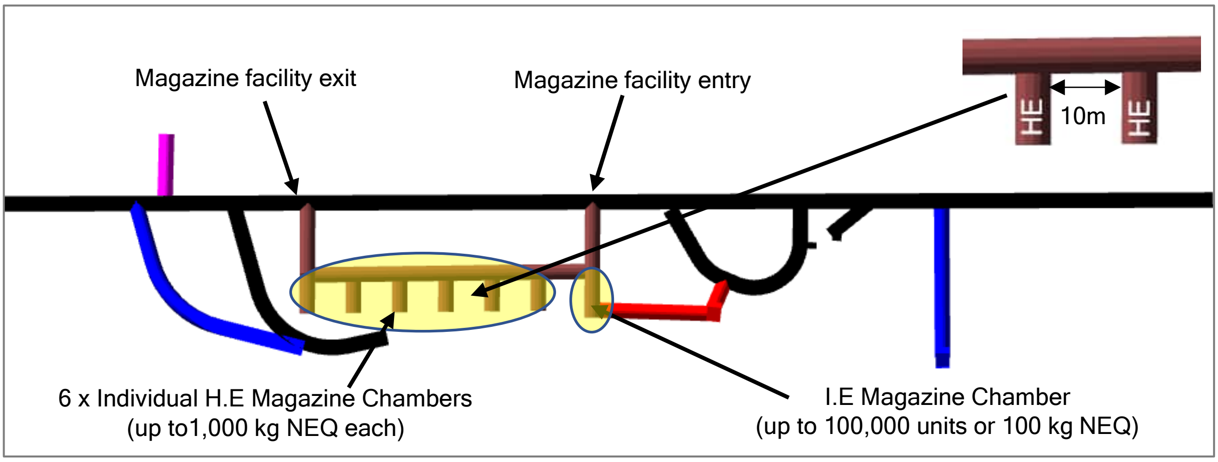
The site is conceptually located in the footwall of the orebody along one of the main access drives.

The surface position directly above the proposed magazine location consists of remote and uninhabited forested area. The surface position above the proposed magazine facility is at approximately RL223 m. The proposed facility is located approximately 380 m below that surface position.



'Figure 2 - Isometric view of proposed WUG underground magazine facility position'.

Figure 3 shows the proposed facility layout. Separation distances are deemed appropriate in order to mitigate risk of propagation and mass detonation beyond a singular magazine chamber. A maximum stored capacity of 1,000 kg (NEQ) per magazine chamber has been used to estimate controlled zone offsets at all surface connections.



'Figure 3 - Magazine chamber layout including separation distances and proposed stored quantities'.

4.1 Blast Propagation by Rock Spall

In order to assess the likelihood of propagation between explosive chambers/ magazines by way of 'rock spall', '*Annex M' of 'IATG 2.20*', has been referenced.

Propagation by Rock Spall (Hard Rock) D_{cd} (Loading Density < 270kg/m^3)	D1[58]	**$0.6Q^{1/3}$**	A minimum of 5m shall be applied.

In consideration of the 'loading density' (kg/m^3) – this is the calculated volume ratio (kg/m^3) stored within the explosive's magazines – in this instance the proposed loading density can be shown in the following.

In consideration of the maximum stored quantity of H.E per chamber, (*where Q = 1,000 kg*)

$$\begin{aligned} Kg/\,m^3 &= NEQ\,(kg)/\,Magazine\ volume \\ &= 1{,}000\ kg\,/\,627\ m^3 \\ &= \underline{1.6\ kg/m^3} \end{aligned}$$

In consideration of known loading density, '*ANNEX M*' provides the following formula to establish a minimum separation distance between magazine storage in order to mitigate risk of propagation by way of rock spall.

<u>Where Loading Density < 270 kg/m3</u>

$$\begin{aligned} D &= 0.6Q^{1/3} \\ &= \underline{6.0\ m}\ \text{is minimum distance} \end{aligned}$$

In relation to the above scenario of 'propagation by rock spall', the minimum required offset between H.E storage chambers is 6.0 m. The current proposed design of 10 m wall to wall distance between individual chambers is therefore adequate to ensure sufficient mitigation control.

4.2 Blast Propagation by Flames and Hot Gases

In order to assess the likelihood of propagation between explosive chambers by way of 'Flames and Hot Gases, the methodology described in '*Annex M*' of '*IATG 2.20*' has been adopted.

Propagation by Flames and Hot Gases through Cracks and Fissures	CID	**$0.3Q^{1/3}$ to $2.0Q^{1/3}$**	The Q factor should be determined by geological survey. Unlikely to propagate if the CID is greater than 2.0 $Q^{1/3}$.

The 'Chamber Interval Distance (CID)' is the required distance between magazine chambers in order to mitigate risk of propagation by way of 'Hot Flames and Gases'.

'Annex M' provides a range for CID from $0.3Q^{1/3}$ to $2.0Q^{1/3}$ to account for different rock mass conditions. Despite the expectation of competent rock mass conditions, a conservative estimate and scaling factor of '$1.0Q^{1/3}$' has been adopted.

In reference to H.E magazine chambers (being the highest stored quantity), where Q = 1,000 kg)

$$\begin{aligned} Required\ CID &= 1.0Q^{1/3} \\ &= \underline{10.0\ m} \end{aligned}$$

The minimum required CID between H.E storage chambers has been calculated at 10.0 m in order to manage potential impacts associated with 'propagation by flames and hot gases. Therefore, the current proposed CID design of 10.0 m is acceptable.

4.3 Other Considerations - Major Damage Prevention to Interior of Facility

When establishing appropriate storage capacities and segregation distances between magazine chambers, appropriate CID should be considered in order to mitigate risk of substantial damage to the interior of facility (in the event of an unintended detonation).

This can be referenced in '*IATG 2.20 - ANNEX M*',

Major Damage Prevention by Rock Spall (Hard Rock) D_{cd} (Loading Density < 50kg/m^3)	D2	**$1.0Q^{1/3}$**	A minimum of 5m shall be applied.

<u>Where Loading Density < 50 kg/m3 (see above)</u>

For the maximum stored quantity of H.E per chamber, (where Q = 1,000 kg)

$$\text{Required CID} = 1.0Q^{1/3} = \underline{10.0\ m}$$

The minimum required CID for 'major damage prevention to interior of facility' has been calculated at distance of 10.0 m. The current proposed design of 10.0 m separation distances between chambers is therefore adequate.

5. Controlled Zones at Surface Connections (Portals and Ventilation Shafts)

There are varying overpressure criteria stipulated under *'HSW (Hazardous Substances) Regulations 2017, r 9.27'* that must be considered in the event of an unintended detonation. Overpressure relates to a significant increase in ambient pressure at a known location (measured in kPa). In the event of an unintended detonation, excessive overpressure would occur in close proximity to the site. Exposure to personnel and infrastructure to such overpressures must be managed.

The managed areas surrounding such locations are known as 'controlled zones'. In the event of an unintended detonation, consideration is given to the potential effects on personnel, infrastructure and buildings. The extent of such surface controlled zones is primarily reliant on the mass of the class 1 substance involved in the unintended detonation event and the distance to the exposure site at the surface location.

Surface magazine facilities use a 'hemispherical burst' calculation methodology. In contrast, an unintended detonation within an underground storage facility is a different scenario, in which the vast majority of hazardous over pressure and hazardous fragments would likely be entirely contained within the underground mine workings and nearer to the storage facility itself.

Estimates undertaken for likely overpressure scenarios at surface connections have been based upon a conservative model of the linear distance from the magazine storage location to the surface, which then allows calculation of underground mine volume. The volume of the shortest path to the surface connection plus the volume associated with the equivalent length along the other tunnel routes has been used in the calculations to estimate overpressures at surface. Additional underground areas (i.e., volume) within the proposed mine development, where overpressure would likely dissipate further, are not considered. It is expected that actual surface effects (overpressure in kPa) would be notably less than outputs calculated.

In consideration of '*International Ammunition Technical Guideline (IATG 2.20), 'Quantity and Separation Distances (United Nations - Safer Guard) (2nd Edition 01.02.2015) - ANNEX M'*, expected safety distances (controlled zones) at surface exits/ ventilation shafts can be calculated against specific criteria. These safety distances have then been scaled in order to provide alignment with New Zealand Regulatory requirements, and the associated kPa thresholds.

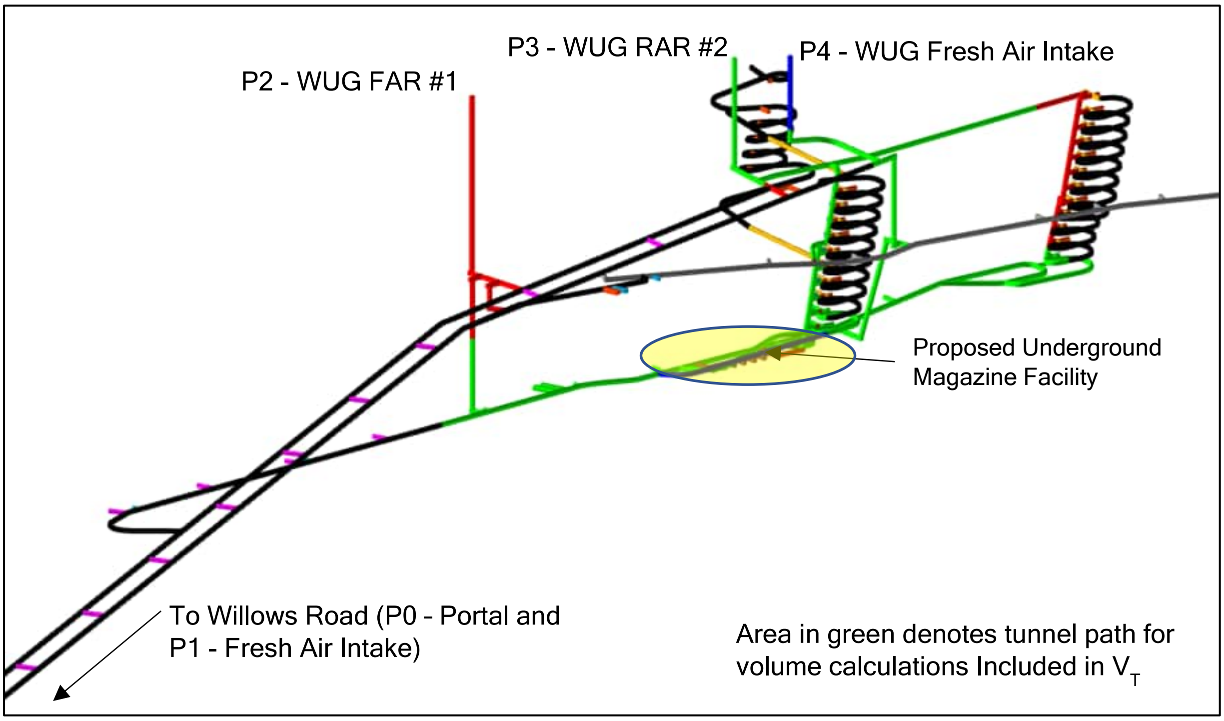
'Annex M' does not provide a category for the 9 kPa threshold criteria. The Quantity Distance (QD) factors are therefore derived from scaling other known criteria such as the 'Inhabited Building Distance (IBD) at 5 kPa and the Public Traffic Route Distance (PTRD) of low traffic density at 13 kPa.

In order to quantify the actual potential effects of 'unintended detonation' related to over pressure and associated controlled zones, there are a number of elements which need to be established. These are summarised below.

- Location at surface of exit/ entry portals and ventilation shafts.
- Quantity of explosives being stored (NEQ) and likely singular detonation mass.
- Size of magazine chamber.
- Total likely underground mine development/ tunnel volume associated with overpressure flow pathway.
- Hydraulic diameter at tunnel entrance or ventilation shaft surface connection.

Figure 5 shows the proposed design volume used to calculate controlled zones. This method is highly conservative and omits a significant quantity of alternate travel avenues for an overpressure event.

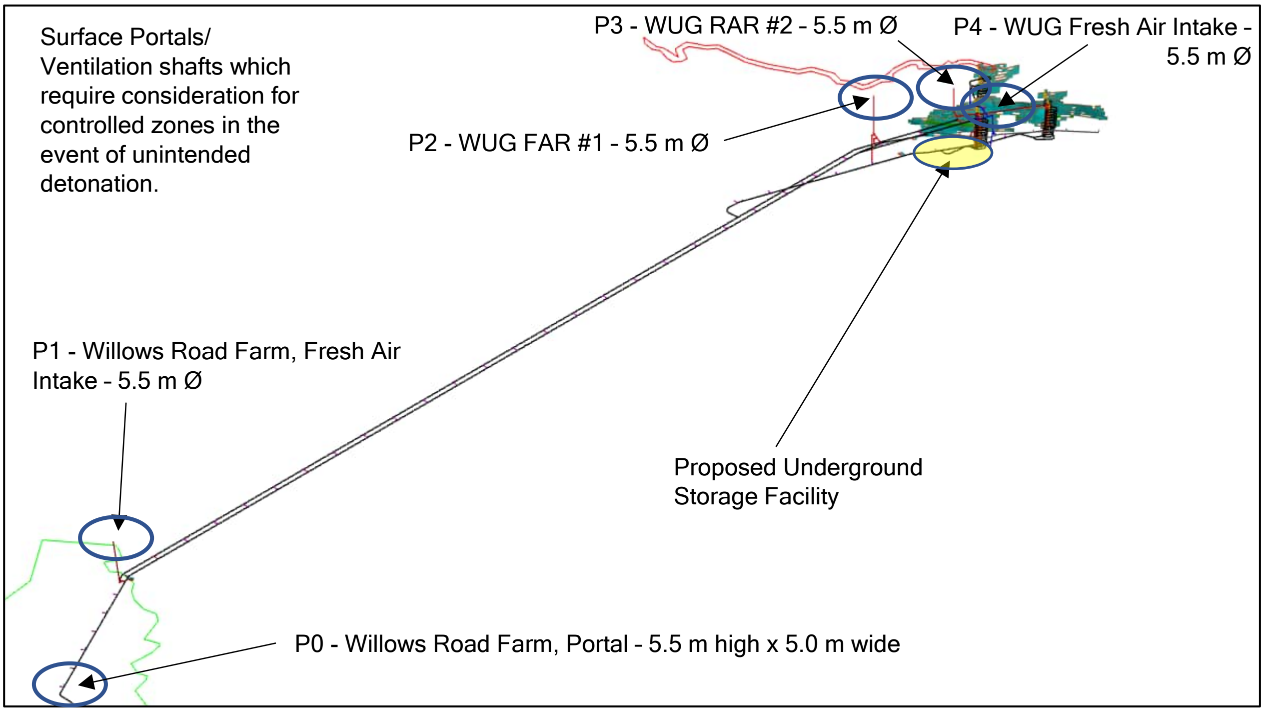
For the purpose of establishing a minimum base scenario at the proposed magazine facility location, the total volume in consideration for each surface portal/ ventilation shaft connection has been calculated as the lowest of all likely travel paths at ~90,229 m^3 (refer to green coloured tunnels and shafts shown in Figure 4) This allows for highly conservative assumptions that likely overstate the effects at surface.



'Figure 4 – Proposed mine workings used to calculate total volumes for controlled zone consideration'.

5.1. Location of Surface Portals and Vent Shafts

There are a number of proposed ventilation shafts and a surface portal that are to be considered for over pressure venting and associated controlled zone calculations. Figure 5 indicates the proposed locations of these surface connections. The final positioning and parameters of the surface connections will be established during the later stages of site design prior to construction. This will influence the final calculation of controlled zones and the required offsets restricting public access.



'Figure 5 - Overview of magazine facility position in relation to surface connections'.

<u>Site P0 – Willows Road Farm Portal (Latitude - 37°21'9.75"S, Longitude - 175°51'33.97"E)</u>

The main access portal to the WUG Mine consists of a large horizontal decline that is used as the main entry and exit to the underground mine.

The portal is located within OGNZL owned land. OGNZL personnel working in the immediate area will be managed by way of an Emergency Response Plan (ERP).

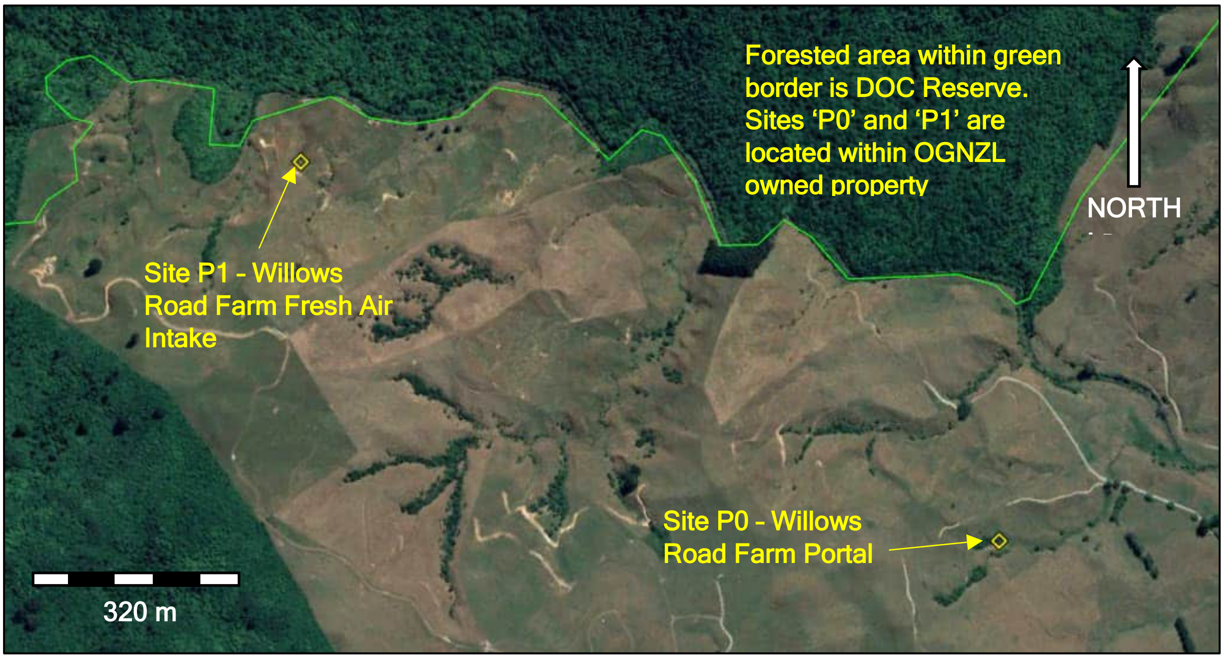
All controlled zones at this location are less than one metre in diameter from edge of portal, therefore will have no impact on any site infrastructure.

<u>Site P1 – Willows Road Farm Fresh Air Intake (Latitude - 37°20'50.05"S, Longitude - 175°50'48.18"E)</u>

The fresh air intake is located within OGNZL owned land. OGNZL personnel working in the immediate area, will be managed by way of an Emergency Response Plan (ERP).

All controlled zones at this location are less than one metre in diameter from the edge of the shaft, therefore will have no impact on any site infrastructure.

Figure 6 shows the location of the proposed surface connections 'P0' and 'P1'. The surface controlled zones at these two locations are less than one metre in diameter from the edge of the shaft and are therefore not visible at this scale.



'Figure 6 - Aerial view of surface connection 'P0 and P1' on OGNZL property'.

Site P2 – WUG FAR #1 (Latitude - 37°18'19.64"S, Longitude - 175°49'19.89"E)

The WUG Fresh Air Return #1 is proposed to have a diameter of up to 5.5 m and be located within the HDC paper road boundary in a remote forested area. The proposed location will consist of a 10 m x 10 m area with a perimeter fence restricting access to members of the public.

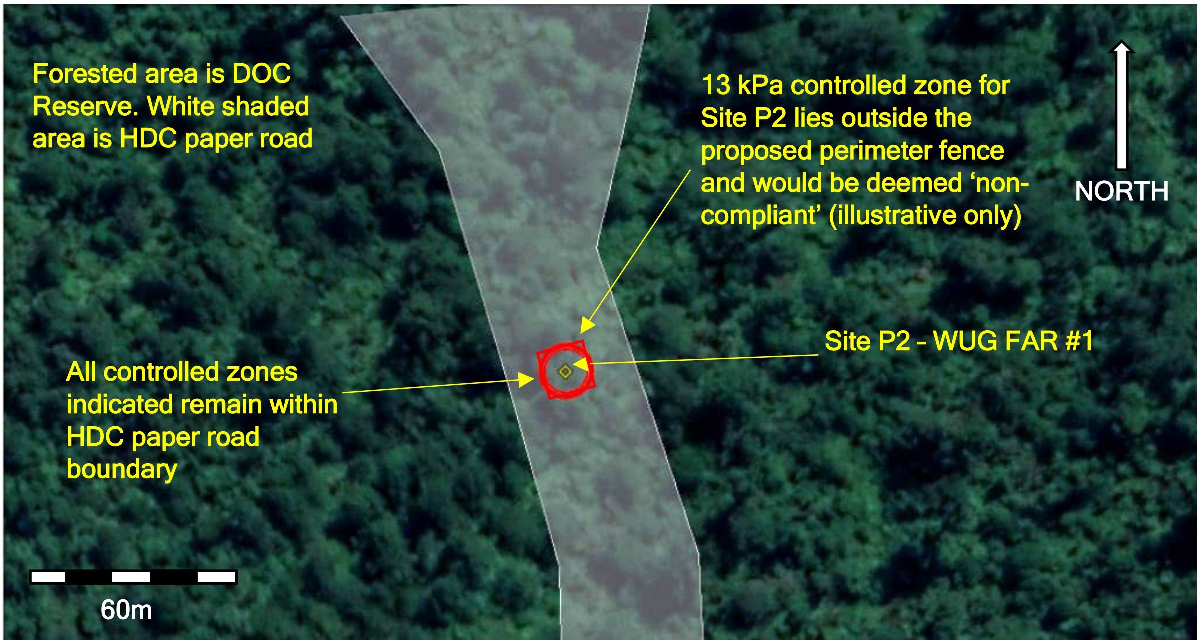
In the event of an emergency situation, any OGNZL site personnel within the perimeter fence will be managed by way of ERP.

All controlled zones at this location are less than 3.8 m from edge of the shaft. No infrastructure is present at this location that could be affected by controlled zones.

Based upon the proposed maximum stored capacity of 1000 kg (NEQ per chamber), the calculated controlled zone offset distance relevant to members of the public (13 kPa) is 2.3 m at this site. Given the publicly excluded area is limited to 10 m diameter, to achieve regulatory compliance with the 13 kPa limit at this location it is proposed that either:

- The vent shaft diameter be limited to 5.25 m; or;
- The stored quantity of explosives per magazine be limited to 950 kg (NEQ).

A combination of the above elements may also be considered during the final design phase of the project, whereby a moderate reduction in both shaft diameter and stored capacity could be implemented to achieve compliance with the 13 kPa limit. However, if a reduction in maximum capacity for magazine chambers is considered, it will be based upon 'Site P3' where the controlled zone offset distance relevant to members of the public is greatest.



'Figure 7 - Aerial view of 'Site P2' surface connection located within HDC paper road'.

Site P3 - WUG RAR #2 (Latitude 37°18'6.60"S, Longitude - 175°49'20.38"E)

The WUG Return Air Rise #2 is proposed to have a diameter of up to 5.5 m and be located within the HDC paper road boundary in a remote forested area. The proposed location will consist of a 10 m x 10 m area with a perimeter fence restricting access to members of the public.

In the event of an emergency situation, any OGNZL site personnel within the perimeter fence will be managed by way of ERP.

All controlled zones at this location are less than 4.7 m from edge of the shaft. No infrastructure is present at this location that could be affected by controlled zones.

Based upon the proposed maximum stored capacity of 1000 kg (NEQ per chamber), the calculated controlled zone offset distance relevant to members of the public (13 kPa) is 2.9 m at this site. Given the publicly excluded area is limited to 10 m diameter, to achieve regulatory compliance with the 13 kPa limit at this location it is proposed that either:

- The vent shaft diameter be limited to 4.75 m Ø; or;
- The stored quantity of explosives per magazine be limited to 750 kg (NEQ).

A combination of the above elements may also be considered during the final design phase of the project, whereby a moderate reduction in both shaft diameter and stored capacity could be implemented to achieve compliance with the 13 kPa limit. However, if a reduction in maximum capacity for magazine chambers is considered, it will be based upon this site where the controlled zone offset distance relevant to members of the public is greatest.

Site P4 - WUG Fresh Air Intake (Latitude - 37°18'4.04"S, Longitude - 175°49'20.75"E)

The WUG Fresh Air Intake is proposed to have a diameter of up to 5.5 m and be located within the HDC paper road boundary in a remote forested area. The proposed location will consist of a 10 m x 10 m area with perimeter fence restricting access to members of the public.

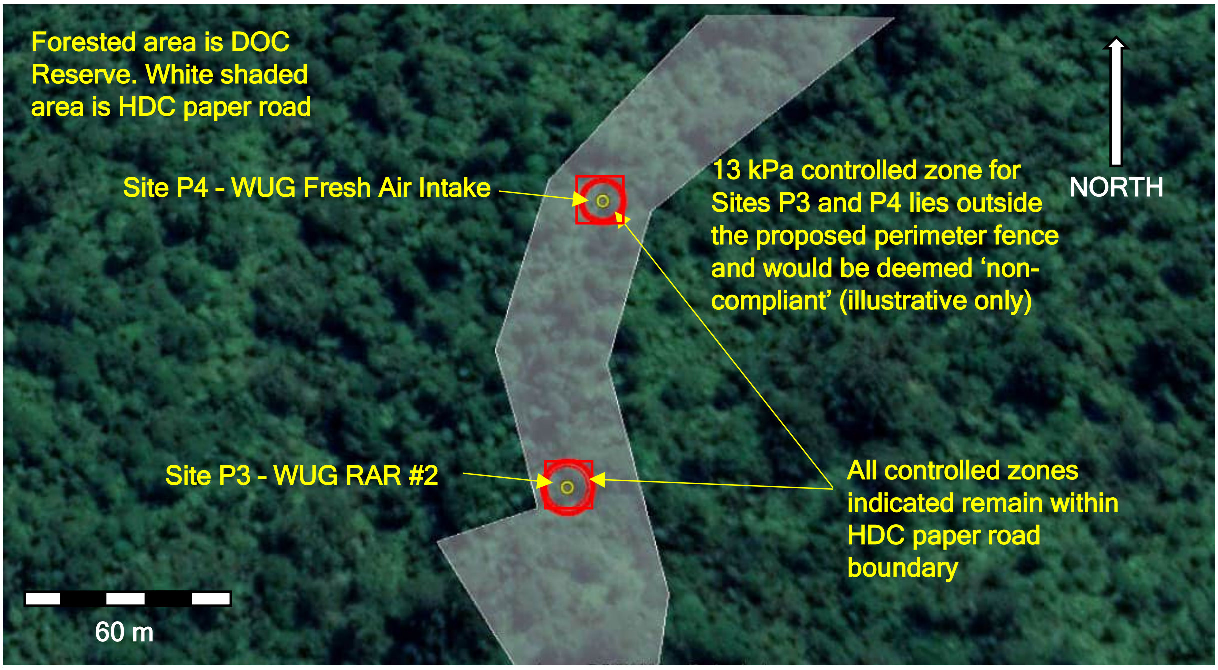
In the event of an emergency situation, any OGNZL site personnel within the perimeter fence will be managed by way of ERP.

All controlled zones at this location are less than 3.9 m from edge of the shaft. No infrastructure is present at this location that could be affected by controlled zones.

Based upon the proposed maximum stored capacity of 1000 kg (NEQ per chamber), the calculated controlled zone offset distance relevant to members of the public (13 kPa) is 2.4 m at this site. Given the publicly excluded area is limited to 10 m diameter, to achieve regulatory compliance with the 13 kPa limit at this location it is proposed that either:

- The vent shaft diameter be limited to 5.25 m Ø; or;
- The stored quantity of explosives per magazine be limited to 900 kg (NEQ).

A combination of the above elements may also be considered during the final design phase of the project, whereby a moderate reduction in both shaft diameter and stored capacity could be implemented to achieve compliance with the 13 kPa limit. However, if a reduction in maximum capacity for magazine chambers is considered, it will be based upon 'Site P3' where the controlled zone offset distance relevant to members of the public is greatest.



'Figure 8 - Aerial view of 'P4 and P5' surface connection located within HDC paper road'.

5.2 Considerations in Establishing Surface Controlled Zones.

'ANNEX M, of *IATG 2.20'* considers a number of factors when establishing a magazine location. The primary factor is the detonation mass in the event of an unintended detonation. This figure is then used in the estimation of the surface controlled zone offsets described in accordance *'Health and Safety at Work (Hazardous Substances) Regulations 2017, r 9.27'.*

The proposed storage facility will store several types of explosive substances in order to meet operational needs. Some of these substances require segregation, which has been considered in the design.

The proposed facility consists of the following quantities stored in seven separate magazine chambers.

- Six magazine chambers will be utilised for varying commercial explosive substances (H.E) with up to 1,000 kg (NEQ) per magazine chamber.
- One magazine chamber will be utilised for storage of up to 100,000 detonators (100 kg NEQ) of varying types.

5.3 Blast from Tunnel Entrance – Controlled Zone Effects.

The 'blast distance from tunnel entrance' formula outlined below have been utilised to estimate the radius of the surface controlled zones.

Blast from Tunnel Entrance[59 60]	IBD PTRD[61]	**$D = 77 \times H_D \times LD^{1/3}$**	Where: H_D = Hydraulic Diameter of Tunnel Mouth $LD^{1/3}$ = Loading Density (kg/m^3)
		$H_D = 4A/C$	Where: A = Cross-sectional Area of Tunnel Entrance (m^2) C = Circumference of Tunnel Entrance (m)
		$LD^{1/3} = \frac{NEQ}{(V_{Ch} + V_{Tunnel})}$	V_{Ch}= Chamber Volume (m^3) V_{Tunnel} = Tunnel Volume (m^3)

The total volume (tunnel volume) in consideration of the nearest surface connection (WUG RAR #2) from the magazine facility has been established at ~90,229 m^3.

All controlled zone calculations at surface connections have been based upon the assumption of a singular detonation event in one magazine chamber only. The largest stored quantity (NEQ) of 1,000 kg (H.E.) has been used.

All tunnel and magazine chamber volume calculations have been undertaken and provided by Oceana Gold and are based upon the currently proposed mine designs.

Varying types of commercial explosives (H.E or I.E) will be stored in each of the seven magazine chambers. All controlled zone calculations are based upon '*TNT equivalence*' (See definitions).

'ANNEX M' of IATG 2.20' describes specific 'Quantity Distance' (QD) factors in relation to known criteria and allowable surface overpressure outputs. Some of the criteria align with New Zealand Regulations. For example, Inhabited Building Distance (IBD') would be equivalent to 5 kPa within *Health and Safety at Work (Hazardous Substances) Regulations 2017', r 9.27 (2)(c)*). However, other criteria within the New Zealand Regulations such as *'public traffic routes of medium density – 9 kPa (r 9.27 (2)(b))* have no comparable QD factors available. In the absence of appropriate QD factors, such criteria have been scaled against known QD factors within *Annex M* to align with remaining controlled zones detailed in *'Health and Safety at Work (Hazardous Substances) Regulations 2017', r 9.27*.

'Health and Safety at Work (Hazardous Substances) Regulations 2017', r 9.27, considers several controlled zone threshold requirements. A summary of these is included in the following paragraphs along with a description of how each surface connection complies with the legislative requirements.

Controlled zone definition – 24 kPa

r 9.27(4)(a) *– A PCBU with management or control of a hazardous substance location that is used solely for securing and holding a class 1 substance must limit the quantities of any class 1 substance at the location to ensure that, in the event of an unintended initiation, -*

i. the interior of any proximate building where a class 1 substance is manufactured would not be subject to a blast overpressure of more than ***24 kPa.***

Formula for minimum offset distance in accordance with the above criteria - *$D = 16 \times H_D \times LD^{1/3}$*

Proposed class 1 site - Compliance summary for 24 kPa controlled zone.

- This is currently not applicable as the manufacture of class 1 substances at the site is not being considered at present.
- Should manufacture be considered, this would likely occur at a surface facility only. In the instance where Ammonium Nitrate (A.N) was to be used, '*Table 3.2.3.2', Associated Works'* of '*AS 2187.1'* would then apply in relation to minimum offsets to 'A.N storage.
- Controlled zone offsets shall be considered if class 1 manufacture does occur.

NOTE – While *Annex M* indicated a specific QD factor for 'Process Building Distance' (PBD), an alternate QD factor was applied in order to align with '*HSW (Hazardous Substances) Regulations 2017*', where controlled zone calculations reference 24 kPa as opposed to 21 kPa criteria indicated within *Annex M of IATG 2.20.*

Controlled zone definition – 13 kPa

r 9.27(2)(a)(i) *- public traffic routes of low density and places where people may occasionally be present in numbers up to 200 persons on average in any 24-hour period are not subject to any of the following:*

i. a blast overpressure more than ***13 kPa.***

This would be considered equivalent to 'PTRD' (Public Traffic Route Distance) within *'ANNEX M'*. However, '*for minor routes, 2/3 of IBD may be used in all cases' (77 x 0.66 = 51)*

Formula for minimum offset distance in accordance with the above criteria - $D = 51 \times H_D \times LD^{1/3}$

Proposed class 1 site - Compliance summary for 13 kPa controlled zone.

- This applies to any person in a public or private place within this zone irrespective of number or density.
- Where ventilation shaft surface connections are located on public land (HDC paper road boundary), members of the public must remain outside this controlled zone.
- Fencing will be constructed around each ventilation shaft surface connection. The fenced area will have dimensions of 10 m in diameter, concentric with the vent shaft (and will restrict public access.
- Compliance with the 13 kPa controlled zone requirements at sites P2, P3 and P4 can be managed through design consideration of ventilation shaft diameters and or maximum allowable stored capacity for each magazine chamber.
- The 13 kPa controlled zone remains within the HDC paper road boundary (and does not encroach DOC Reserve)
- In the event of an emergency situation, all OGNZL personnel within this zone shall evacuate to 5 kPa controlled zone (minimum).
- The zone will be managed by way of OGNZL ERP and an appropriate evacuation plan.

Controlled zone definition – 9 kPa.

r 9.27(2)(b)(i) - *public traffic routes of medium density, places where people may occasionally be present in numbers up to 900 persons on average in any 24- hour period, and the interior of any proximate building within the boundary of the place where people not directly handling explosive substances are present are not subject to any of the following:*

i. a blast overpressure more than ***9 kPa.***

Formula for minimum offset distance in accordance with the above criteria – $D = 64 \times H_D \times LD^{1/3}$

Proposed class 1 site - Compliance summary for 9 kPa controlled zone.

- This applies to public traffic routes of medium density, which are not present at any of the surface locations.
- Applies to the interior of any proximate building on site not related to handling of explosives (e.g., office, lunch room etc.).
- There is no exposure to any 'un-related' occupied building within the controlled zones on OGNZL land.
- There is no impact where the controlled zones cross into public areas (either DOC Reserve or HDC paper road)

- Where controlled zone is located on OGNZL property, this can be managed by way of OGNZL ERP and evacuation plans.
- In the event of an emergency situation, all OGNZL personnel within this zone shall evacuate to 5 kPa controlled zone (minimum).

Controlled zone definition – 5 kPa

r 9.27(2)(c)(i) *- public traffic routes of high density, areas of high intensity land use, or any area where a person may be legally present inside the boundary of the place where the hazardous substance location is located are not subject to any of the following:*

*i. a blast overpressure more than **5 kPa.***

Formula for minimum offset distance in accordance with the above criteria – $D = 77 \times H_D \times LD^{1/3}$

Proposed class 1 site - Compliance summary for 5 kPa controlled zone.

- Applies to any person legally inside boundary of OGNZL owned land, whether employees or members of the public irrespective of number or density.
- Does not apply to 5 kPa controlled zones surrounding surface connections in public areas (DOC Reserve or HDC paper road) as this is a public place, and is not 'inside the boundary'.
- The controlled zone at surface connections on public places (DOC Reserve or HDC paper road) does not cross into any public high density traffic routes or area of high intensity land use.
- Where controlled zones cross into public areas (either DOC Reserve or HDC paper road) there is no impact.
- Where controlled zone is located on OGNZL property – this can be managed by way of OGNZL ERP and evacuation plans. The emergency muster location must be outside this area.

Controlled zone definition – 2 kPa.

r 9.27(2)(d) *- vulnerable facilities are not subject to more than a blast overpressure of **2 kPa.***

Formula for minimum offset distance in accordance with the above criteria – $D = 83 \times H_D \times LD^{1/3}$

Proposed class 1 site - Compliance summary for 2 kPa controlled zone.

- There are no vulnerable facilities where 2 kPa controlled zones cross into public land (DOC Reserve or HDC paper road). Surface connection controlled zones within those public areas would be fully compliant.
- There are no vulnerable facilities with controlled zones on OGNZL property.

5.4 Controlled Zone Offsets Applicable to Surface Connections

In the event of an unintended detonation of stored substances within a singular magazine chamber containing 1,000 kg (NEQ) of H.E, the estimated controlled zones shown in Table 1 would apply to each surface connection.

Controlled zone calculations have been based upon proposed dimensions at the surface portal connection of 5.0 m x 5.5 m and a diameter at all surface ventilation shafts of 5.50 m.

Controlled Zone Offset Table in Relation to Surface Ventilation Shafts and Portal						
Location ID and Description	Calculated Volume Available	Vulnerable Facilities (2 kPa Eq.)	IBD/ PTRD (5 kPa)	Interior of Buildings (9 kPa)	Public Places/ Low density traffic routes (13 kPa)	PBD (24 kPa)
Site P0 Willows Rd Farm Portal	642,338 m^3	<1 m	<1 m	<1 m	<1 m	<1 m
Site P1 Willows Rd Farm, Fresh Air Intake	611,519 m^3	<1 m	<1 m	<1 m	<1 m	<1 m
Site P2 WUG FAR #1	114,933 m^3	3.8 m	3.5 m	2.9 m	2.3 m	<1 m
Site P3 WUG RAR #2	90,229 m^3	4.7 m	4.4 m	3.7 m	2.9 m	<1 m
Site P4 WUG Fresh Air Intake	109,839 m^3	3.9 m	3.7 m	3.0 m	2.4 m	<1 m

Table 1 - Controlled zone offset distances specific to each surface connection.

Distances shown in above table are measured from the outer diameter of the surface portal/ ventilation shaft in which the controlled zone would apply. Total volume used for controlled zone calculations varies according to the surface connection being considered.

6 Additional Regulatory Compliance for Class 1 Storage Facilities

The '*Health and Safety at Work (Hazardous Substances) Regulations 2017'* stipulate requirements for a PCBU in relation to mitigating risk from storage of class 1 substances. These include, but are not limited to the following items.

- *Part 5 - Emergency Management.*
- *r 9.5 - Controlled substances licence generally required for class 1 substances.*
- *r 9.11 - Limits on impact or pressure shock.*
- *r 9.12 - Limits on spark energy.*
- *r 9.13 - Limits on heat and fire.*
- *r 9.14 - Limits on static electricity in relation to equipment.*
- *r 9.15 - Protection from stray electrical currents.*
- *r 9.16 - Protection from electromagnetic radiation.*

Compliance with the above stated regulations can be managed by way of industry best practice.

In addition to compliance with '*HSW (Hazardous Substances) Regulations 2017*', further storage facility design requirements can be referenced in '*AS 2187.1 - Section 2.6 'Underground Storage'.*

Additional requirements are summarised below;

- Magazine chamber design (also refer *AS 2187.1* for build specification).
- Security requirements.
- Signage requirements.
- Emergency response and evacuation (engagement with *FENZ* if required).
- Earthing requirements.
- Qualification, training and competence of class 1 handlers.

- Fire suppression systems (*also refer AS 2187.1*).
- Appropriate lighting (intrinsically safe).
- Ventilation.

Additional obligations relating to facility administration and OGNZL site personnel working with class 1 substances are addressed in *'Parts 1-8, HSW (Hazardous Substances) Regulations 2017'.*

7 Location Compliance and Magazine Certification Requirements

Within *'r.6.23 and r.9.26'* of the '*Health and Safety at Work (Hazardous Substances) Regulations 2017',* there is a requirement for annual certification of a site containing certain quantities of hazardous substances. The proposed facility falls into that category and will require such certification.

The underground storage facility would be considered a new and separate storage location from all other certified class 1 storage facilities at the Waihi Gold operations. It will be assessed and certified separately against specific regulatory requirements.

Annual 'Location Certification' is a requirement of all class 1 storage facilities of this nature. An inspection will be carried out prior to initial Certification to ensure regulatory compliance.

In addition to the compliance certification process, notification shall be given to Worksafe New Zealand in accordance with '*r 9.22 (4) of HSW (Hazardous Substances) Regulations 2017'.* This notice must be provided at least 30 working days prior to the commissioning of the hazardous substance storage facility.

8 Conclusion and Summary

In respect of controlled zones within OGNZL owned land (Sites P0 and P1), and based upon the current WUG design, the proposed concept for the class 1 storage facility is considered compliant with the controlled zone offset requirements described in*' r 9.27, HSW (Hazardous Substances) Regulations 2017'.*

Potential effects on site personnel within OGNZL owned land can be managed with the development of an effective site-specific ERP. Proposed site infrastructure within OGNZL owned land is not affected by identified controlled zones.

Consideration should be given to future infrastructure development on OGNZL land that may be located in proximity to proposed surface connections.

13 kPa controlled zones surrounding sites P2, P3 and P4, relating to members of the public within public areas such as, DOC Forest Reserve or HDC paper road, have been considered. Based upon the proposed perimeter fenced area of these surface connections, the proposed magazine will be developed to comply with the controlled zone offset requirements by optimising vent shaft diameters and magazine capacity.

The relationship between ventilation-shaft controlled zones and the public exclusion zone will determine final design considerations in relation to the class 1 storage facility.

There is currently no public infrastructure existing within the DOC Reserve or HDC paper road areas surrounding the sites or the associated controlled zones. The identified areas are unlikely to have any infrastructure development in future.

Due to a very low expected over pressure output, combined with the complex nature of the underground mine tunnel system, it is deemed highly unlikely that any ejection of material at surface portals/ ventilation shafts other than minor dust and small non-hazardous matter would occur.

The operation of underground class 1 storage magazines is common practice throughout global mining operations. The proposed storage volumes would be considered relatively low when compared with other underground magazines in regions with a greater density of underground mining operations.

Ongoing and future mining operations and extraction of material, will have a beneficial effect and further reduce calculated controlled zone offsets due to the increase in tunnel volume.

Prior to final commissioning of underground class 1 storage facility – assessment will be undertaken by an independent Compliance Certifier that will ensure the site is appropriate in its design, positioning and proposed capacities to enable Location Compliance Certification.

Reported compiled and submitted – 10th December 2021

Nathan Cotter

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Terms and Definitions

Area of high intensity land use - in relation to an area beyond the boundary of a place where a hazardous substance location is situated, includes an area of *regular habitation*, any other hazardous substance location, and a high-density traffic route.

AS 2187.1 – Australian Standard 2187.1-1998, Explosives – Storage, Transport and Use – Storage'.

A.N (Ammonium Nitrate) - Class 5 substance used in manufacture of bulk commercial explosives.

Certified Handler – Person authorised by Worksafe NZ to handle explosives.

Compliance Certifier – Independent person authorised by Worksafe NZ, to certify among other items - hazardous substance locations and storage containers to ensure compliance with the New Zealand Regulatory Framework.

CID (Chamber Interval Distance) – The distance between each magazine chamber consisting of solid unmined material.

Compliance Certificate (Location) – a certificate issued under '*HSW (Hazardous Substances) Regulations 2017*'to allow storage of specific hazardous substances at a location.

Controlled Zone - An area abutting a hazardous substance location that is regulated.

E.P (Emulsion Phase) - Emulsion solution made from A.N used as a base for commercial bulk explosives.

E.R.P (Emergency Response Plan) – A detailed plan at a work site detailing actions for all personnel and effected parties in the event of an emergency.

E.S (Exposed Site) - Relates to an exposed site in respect of a storage location (Inhabited building).

F.A.R (Fresh Air Return) – Forms part of Underground tunnel/ mine ventilation system.

HSW (Hazardous Substances) Regulations 2017 – primary governing regulations for hazardous substances. HSW meaning '*Health and Safety at Work'.*

HSWA (Health and Safety at Work Act 2015) – Over-arching legislation that derives Health and Safety Regulations.

H.E (High Explosives) - Relates to commercial explosive products such as boosters, detonating cord, and packaged emulsions and are generally considered the 'secondary' explosive.

I.E (Initiating Explosives) - Relates products such as detonators used for initiation of secondary explosive.

I.B.D (Inhabited building distance) – distance to a residential dwelling.

I.M.D – (Inter-magazine distance) - Distance between individual magazine units storing class 1 substances. (Distance may be reduced with addition of appropriate mounding or barrier wall).

kPa (Kilopascals) – A unit of pressure used as a reference to determine potential harm/ damage criteria.

Magazine – Reference to storage container/ chamber used for securing for class 1 substances.

N.E.Q (Net Explosive Quantity). Used to evaluate the total net explosive quantity (kg) excluding packaging.

Offsets – a known separation distance required by regulations in order to comply – usually referring to the distance between a hazardous substance to people, places, infrastructure or specific features.

Overpressure – relates to higher than standard atmospheric pressure relating to the effects on personnel and or buildings/ infrastructure. Measured in 'kilopascals' (kPa).

P.B.D (Process Building Distance) – Distance from a building manufacturing class 1 substances.

P.E.S (Potential Explosion Site) – Site that may detonate (Magazine facility).

P.C.B.U (Person Conducting a Business or Undertaking) – Regulatory definition of a senior person within a business or undertaking.

P.T.R.D (Public Traffic Route Distance) - Usually refers to a road or path and generally classified as 'high' or 'low' density, dependent upon number of persons in a 24-hour period.

R.A.R (Return Air Rise) – Forms part of Underground tunnel/ mine ventilation system.

TNT Equivalence – a normalization technique where a standardised unit of measurement is used in predicting overpressures for class 1 storage facilities. (TNT being a generic high explosive)

The majority of air blast and impulse equations predict against the effects of TNT, and it is therefore desirable to convert the explosive mass into equivalent TNT charge mass.

Vulnerable Facility – Sensitive building of high construction made from specific materials, or specific buildings associated with aged care facilities, hospitals, education facilities.

Additionally – public buildings/ structures of historic nature or public utilities whose service could be disrupted by a blast of 5 kPa.

Reference A – Legislative Framework within New Zealand

i. *Health and Safety at Work Act 2015.*

ii. *Health and Safety at Work Act (Hazardous Substances) Regulations 2017.*

iii. *Health and Safety at Work General Risk and Workplace Management Regulations 2016.*

iv. *Health and Safety at Work Mining Operations and Quarrying Operations Regulations 2016.*

Reference A – Supporting Standards and Guidance

- *International Ammunition Technical Guideline (IATG 1.80), 'Formulae for Ammunition Management (United Nations - Safer Guard) (2nd Edition 01.02.2015).*

- *International Ammunition Technical Guideline (IATG 2.20), 'Quantity and Separation Distances (United Nations - Safer Guard) (2nd Edition 01.02.2015).*

- *AS 2187.1 – Explosives – Storage, Transport and Use, Part 1; Storage.*

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Appendix C Site plans

LEGEND:

EXISTING

- CONTOUR (2m)
- CONTOUR (10m)
- OGLNZ BOUNDARY
- PROPERTY BOUNDARY
- EXISTING STREAM
- OVERLAND FLOW
- WETLAND
- WETLAND 20m OFFSET CLEARANCE ZONE

PROPOSED

- MAJOR CONTOUR (5m)
- MINOR CONTOUR (1m)
- EXTENT OF SURFACE
- OVERLAND FLOW
- OVERHEAD POWER
- RIP RAP
- CULVERT

PROPOSED: EGL DESIGN ONLY

- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- PERIMETER ACCESS TRACK
- WRS UNDERDRAIN
- CULVERT
- SUBSOIL
- GEOLADDER

NOTES:

1. HORIZONTAL COORDINATE SYSTEM: NZGD2000 MOUNT EDEN CIRCUIT
2. EXISTING SERVICES ARE NOT SHOWN
3. AERIAL PHOTOGRAPH OBTAINED FROM LINZ DATA SERVICE ON 16/12/2024: Waikato 0.3m Rural Aerial Photos (2021-2024)
4. EXTENTS OF BUNDS ARE SHOWN INDICATIVELY. EXTENTS OF THE NOISE BUNDS ARE TO BE CONFIRMED IN DETAILED DESIGN

ORIGINAL DRAWING IN COLOUR

FOR INFORMATION
NOT FOR CONSTRUCTION

BECA DWG No: **3936538-CA-1001**

No	Revision	Drawn	Checked	Appvd.	Date
O	FOR INFORMATION	RTS			
N	FOR INFORMATION - UPDATE BASED ON OGNZL COMMENTS	RTS	JK	EG	28.01.25
M	FOR INFORMATION - EGL DESIGN UPDATE	RTS	JK	EG	18.12.24
L	FOR INFORMATION - ADDITIONAL HELIPORT AREA	LM	JvZ	JvZ	11.10.23
K	FOR INFORMATION - JN CHANGE AND SITE LAYOUT CHANGES	HEK	JvZ	EG	15.06.23

Note: * indicates signatures on original issue of drawing or last revision of drawing

Beca

Engineer: H. KERR

PRC No.: 3936538	Date issued.:
PTR No.:	Date issued.:
TIN No.:	Issued at.:

OCEANAGOLD
WAIHI OPERATION

Drafted AWS	Designer AWS
Drafting Check	Design Check
Approved -	
Date	
Scale 1:2000 @ A1	This Drawing must not be used for Construction unless signed as Approved

Project: **WAIHI NORTH PROJECT**

Title: **WILLOWS ROAD SURFACE INFRASTRUCTURE LAYOUT**

Sheet No. 1001

Original Size A1 | Drawing No: **WAI-981-000-DWG-CI-1001** | Rev: O

5 February 2025 - 4:34 pm Plotted By: Victoria Hartstone Cad File No: P:\393\3930483\Stormwater Management Report\1-WIP\CAD\3936538-CA-1001.dwg

No	Revision	Drawn	Checked	Appvd.	Date
B	ISSUED FOR STUDY REPORT	AWS	PJG	PJG	10.12.20
A	FOR INFORMATION	AWS	PJG	PJG	03.11.20

Note: * indicates signatures on original issue of drawing or last revision of drawing

Beca

Engineer: P GLOWREY

PRC No.: 2210835

OCEANAGOLD WAIHI OPERATION

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Drafted AWS | Designer AWS
Drafting Check PJG | Design Check
Approved -
Scale 1:500 @ A1

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Project WHARAKIRAUPONGA EXPLORATION DECLINE PROJECT
Title INFRASTRUCTURE DESIGN LAYOUT

Original Size A1
Drawing No: WAI-981-000-DWG-CI-0005

Sheet No. 0005
Rev: B

15 December 2020 - 11:41 am Plotted By: Alistair Stewart Cad File No: P:\2210835\CAD\C3D\Design_WKP Mine\Grading Features\2210835-CA-K005.dwg

Appendix D Hazardous Substances Management Plan

Management Plan

Hazardous Substances

Document Reference: WAI-250-PLN-003

Department:	HSE
Location/Site:	Waihi

	Position/Title	**Name**	**Date**
Authored By	HSE Systems	Sharon Deacon	22/07/2021
Reviewed By	Process Manager Emergency Response Co-ordinator Process Supervisor	Justin Johns Jed Moriarty Brett Twidle	30/08/2021 26/07/2021 30/08/2021
Approved By	Process Manager	Justin Johns	16/12/2021

	Document Name	**Document Reference**
Reference Documents	OGC Corporate Health, Safety and Environment Compliance Standards	OGC-450-STD-001
	PCP – Worker Health	WAI-250-PLN-002
	PCP – Emergency Management Plan	WAI-250-PLN-001
	Product Evaluation Form	WAI-250-FOR-009

Document Issuance and Revision History

Procedure Name: **Hazardous Substances Management Plan**

Document Reference: **WAI-250-PLN-003**

Revision No.	Revision Date	Section	Page	Description of Issuance or Revision	Effective Date
1.0				New Document	23/8/2016
2.0	18/12/2017	All	All	Update to PHMP and included references to new regulations.	18/12/2017
3.0				Next Review	27/12/2018
4.0	21/7/2021	All	All	Minor edits to gramma, spelling formatting, update of supporting documentation and records in appendix. Update to legislation references.	16/12/2021

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1 PURPOSE

To identify, analyse and ensure systems are established and maintained to minimise risk of adverse health effects to all employees and contractors, due to exposure to hazardous substances and dangerous goods produced or used at Waihi Operations-controlled site and to comply with OceanaGold Corporate Environment Hazardous Materials and Chemical Substances standard.

2 SCOPE

This Plan applies to all requirements and activities associated with Hazardous Material and Chemical Substances at Waihi Operations except for:

- Class 1 Hazardous Substances (Explosives - these are covered in the Explosives Principal Hazard Management Plan),
- Class 7 Radioactive Substances – covered in the Radiation Safety Plan and is managed by its own Act Radiation Protection Act.

3 LEGAL REQUIREMENTS

Relevant Acts
Hazardous Substances and New Organisms Act 1996 – and amendments
Health and Safety at Work Act 2015

Relevant Regulations
Health and Safety at Work (Hazardous Substances) Regulations 2017
Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001
Hazardous Substances (Forms and Information) Regulations 2001
Stationary Tanks Connected to a Generator Set) Amendment Safe Work Instrument 2019
Health and Safety at Work (Hazardous Substances – Specification of Design Standards for Low-Pressure Fire Extinguishers) Safe Work Instrument 2019
Health and Safety at Work (Hazardous Substances – Specification of Design Standards for Refillable Cylinders) Amendment Safe Work Instrument 2019
Health and Safety at Work (General Risk and Workplace Management) Regulations 2016
Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016

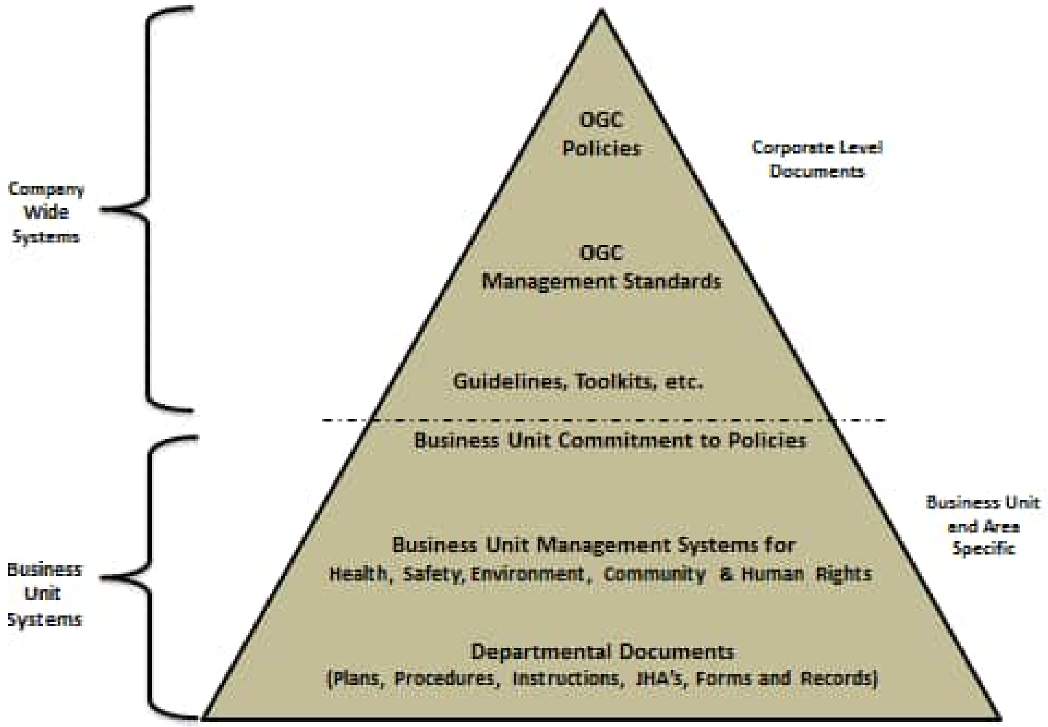
4 MANAGEMENT SYSTEMS

4.1 HSEC Management System

OGNZL's mining activities, by their nature, have the potential to impact the health and safety of people, the environment and communities. These impacts must be identified, evaluated and managed to minimise the risks. The OceanaGold Heath Integrated Management System (IMS), Safety, Environment and Community performance standards are an integral part of OGNZL's business and provide the basis for a HSEC management system. The implementation and maintenance of the management system provides the means to manage and minimise risks, comply with legislation and OceanaGold Standards, and provides the framework for continuous improvement in Health, Safety, Environment and Community management and performance.

The management system follows a hierarchical structure where documents must meet and support the requirements of those of higher levels (see Figure 1).

The scope of the management system covers all activities undertaken by OceanaGold employees and contractors that have the potential to affect Health, Safety, Environmental and Community performance. The IMS and HSEC performance Standards apply to all operations and facilities, including the entire lifecycle of operations, from exploration through to operation and closure, until lease relinquishment occurs.



4.2 Hierarchy of Controls

4.2.1 *Health and Safety at Work Act*

Section 30 and section 6 of the HSAW (General Risk and Workplace Management) regulations outline the control hierarchy and requires that 'so far as is reasonably practicable' steps to control each hazard be taken as required below;

HSAW Act section 30 - Management of risks

(1) A duty imposed on a person by or under this Act requires the person—

(a) to eliminate risks to health and safety, so far as is reasonably practicable; and

(b) if it is not reasonably practicable to eliminate risks to health and safety, to minimise those risks so far as is reasonably practicable.

(2) A person must comply with subsection (1) to the extent to which the person has, or would reasonably be expected to have, the ability to influence and control the matter to which the risks relate.

HSWA General Risk and Workplace Management Regulations section 6 - Hierarchy of Control Measures

(1) This regulation applies if it is not reasonably practicable for a PCBU (Person Conducting Business or Undertaking) to eliminate risks to health and safety in accordance with section 30(1)(a) of the Act.

(2) A PCBU[1] must, to minimise risks to health and safety, implement control measures in accordance with this regulation.

[1] A PCBU is a person undertaking a business or undertaking and is more fully defined in the HSWA Act.

(3) The PCBU must minimise risks to health and safety, so far as is reasonably practicable, by taking 1 or more of the following actions that is the most appropriate and effective taking into account the nature of the risk:

(a) substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk:

(b) isolating the hazard giving rise to the risk to prevent any person coming into contact with it:

(c) implementing engineering controls.

(4) If a risk then remains, the PCBU must minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls.

(5) If a risk then remains, the PCBU must minimise the remaining risk by ensuring the provision and use of suitable personal protective equipment.

4.2.2 *Health and Safety at Work (Hazardous Substances) Regulations*

Section 3.2 Managing risks associated with hazardous substances

(1) A PCBU must manage risks to health and safety associated with using, handling, manufacturing, or storing a hazardous substance or a group of hazardous substances with the same hazardous properties at a workplace.

(2) In managing risks, the PCBU must have regard to the following:

(a) the quantity of the hazardous substances used, handled, manufactured, or stored:

(b) the health and physico-chemical hazards associated with the hazardous substance:

(c) any potential chemical or physical reaction between the hazardous substance and another substance, including a substance that may be generated by the reaction:

(d) any ignition sources (for example, flames, heat, or sparks) that might ignite the hazardous substance:

(e) any structure, plant, or system of work that is used in the use, handling, manufacture, or storage of the hazardous substance:

(f) the nature of the work to be carried out by workers with the hazardous substance, including—

(i) the workers' risks of exposure to the substance; and

(ii) the likely degree of exposure:

(g) any prescribed exposure standard for the hazardous substance:

(h) any restricted entry interval for the substance, if one has been set.

(3) A PCBU who contravenes this regulation commits an offence and is liable on conviction, —

Section 3.3 Duty of PCBU to review control measures

(1) In addition to the circumstances specified in regulation 8 of the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016, a PCBU with management or control of a workplace must ensure that a control measure implemented under this Part in relation to a hazardous substance at the workplace is reviewed and, if necessary, revised in the following circumstances:

(a) after a significant change to—

(i) the safety data sheet for that hazardous substance; or

(ii) the information about that hazardous substance in the PCBU's inventory of hazardous substances:

(b) after any notifiable event in the workplace involving a relevant hazardous substance:

(c) at least once every 5 years.

4.3 Risk Assessment Process

4.3.1 *Training and Competency*

Department managers must ensure that all personnel are trained and assessed as competent in the identification of safety, environmental & community hazards, losses, issues and impacts and assessing the level of associated risk. OGNZL are required to ensure that the risk assessment process is conducted in a consistent manner by personnel who are experienced in the individual process/activity or hazard being assessed.

4.3.2 *Hazard Identification*

Risks are typically associated with events resulting from hazards within a given system. Risk identification involves a detailed review of the system under study to identify the type of energies and associated hazards that are present. Once these hazards are understood, a systematic process to identify the associated risks needs to be followed. There are various techniques available for the identification of hazards as follows:

- Experience/judgment – experienced personnel at all levels provide a sound basis for hazard identification
- Checklists – provide hazards that are common to a particular task or system
- Legislation and OceanaGold Standards - legislation, industry and company standards reflect collective knowledge and experience, accumulated on a broad operational and historic basis
- Accident/Incident investigation – often accident/incident investigations identify hazards that require management action

Hazards may also be identified using any of the following methods:

- Job Hazard Analysis (JHA)
- Preliminary hazard assessment
- Team based risk assessments
- Workplace inspections
- Health hazard assessments
- Internal/external audits
- Environmental monitoring
- Community complaints and consultation
- Internal/external audits
- Pre-shift meetings
- Stop and Think
- Task observations
- Health and safety meetings and committees
- Accident and incident investigations
- Hazard reports
- Social impact assessments

4.3.3 *Risk Management Process*

The OceanaGold risk management process is shown below in Figure 2. Assessments are undertaken using the risk ranking table, risk matrix and risk management table detailed in Appendix II.

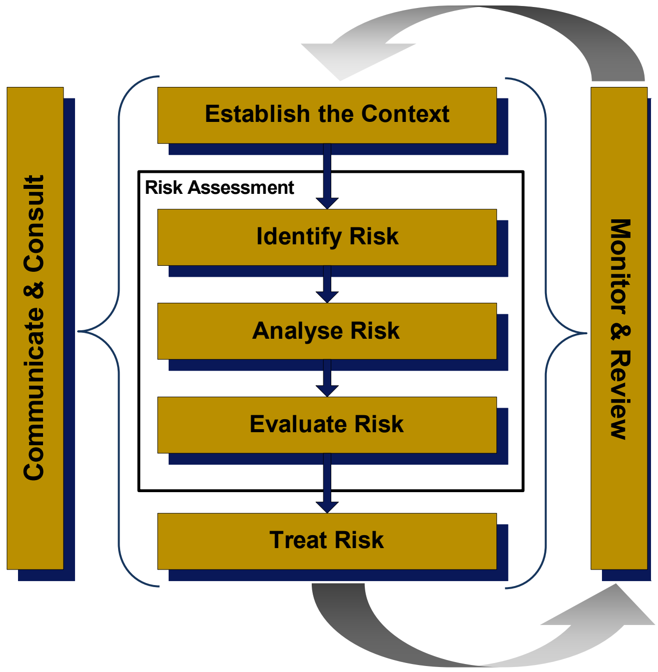


Figure 2 – Waihi Risk Management Process

At least once a year and following any major incident on site or safety alert from another site or industry, a site wide risk register is reviewed and updated by department managers, technical specialists, mine safety representative, and mine operators. This holistic review includes assessment of all significant risks.. Each risk is given context, assigned a consequence and likelihood index, and then plotted on the risk opportunity matrix. If the resultant risk ranking is not deemed satisfactory, a number of additional controls are introduced to bring the residual risk ranking down to an acceptable level. The risk register includes the following elements for each risk:

- A description of the risk
- A list of existing controls
- The current consequence rating
- The current likelihood ratings (with existing controls)
- The resulting assessed current risk level
- A list of future controls
- The person accountable for control of the risk
- A cross reference to the Action Management System (INX) for any future controls
- The target consequence ratings
- The target likelihood ratings
- The resulting assessed target risk level
- The last date the risk was reviewed
- The foreseeable annual loss for extreme risks

Refer to the risk assessment standard for details on each process step; see Appendix I for document details. See Appendix II for the risk ranking tables.

4.4 Preventative and Corrective Actions

To ensure that actions designed to prevent or correct substandard acts, conditions, programs and processes, or to implement opportunities, are properly managed and executed all operations have an Action Management System logged in INX Following the identification of deficiencies/opportunities, the system will:

- Develop actions to address the root cause of the deficiency
- Assign a unique identification number to facilitate tracking and close out of the issue
- Assign a person(s) responsible for each action
- Monitor progress against each action
- Review effectiveness of the implemented action
- Provide a means to identify the action has been effectively addressed and closed out

4.5 Communication

The existence of this MP and its contents shall be communicated to all relevant personnel on site. Communication channels that exist on site include:

Figure 3: Communication channels.

5 HAZARDS IDENTIFIED AND RISK MANAGEMENT

Risk		Potential Cause	Critical Controls
Health Chemical Exposure	Less than adequate competency to store, use and handle hazardous substances. Equipment failure - release or spillage. Incorrect use of PPE. Incorrect PPE. Less than adequate Ventilation and Extraction. Procedures no followed.	Medically treated Injury Lost time Injury Permanent Disabling Injury Nervous system damage.	WAI-250-PLN-003 Hazardous Substances PHMP & Hazardous Substances Risk Register. ChemAlert database & SDS chemical data. Product or Chemical Evaluation assessment. High risk chemical SOPs, Emergency Response. Inductions & Area Training with VoC. Pre-Start Inspections. Plant Automation. Ventilation & extraction systems. Inventory Checks & disposal management. Chemical storage, bunding, segregation. Spill Kits, Wash showers & eye wash stations. personal protective equipment Use of full-face Mask & Respirator filter.
Sodium Cyanide - Delivery, Storage and Use	Spillage contact with personnel	Personal injury or health effects	Cyanide storage area inside bunded shed. Bunded containment to prevent spill escaping to the workplace or environment. Cyanide facility and pipework away from acids, no possible way for acids and cyanide to interact Scrubber on solids mixing tank, automated control systems, interlock control systems to prevent tank overflows, overflow pipework to bund to catch any possible overflow, bund has sump pump rain fall re-directed away from cyanide storage bund to maintain bund storage volume. Fixed HCN monitoring, Materials construction, PPE
Sodium Cyanide Solution (30%) - Storage and Use	Spillage contact with personnel	Personal injury or health effects	Bunded area, splash guards around pipes, flange guards, pumps. Cyanide facility and pipework away from acids with no possibility of acids and cyanides interacting. Cyanide storage and mixing area pipework completely dedicated. Pipework isolated completely from water network. Automatic mixing, transfer dosing, automatic control systems, interlocked control systems to prevent tank overflows, bunded areas with sump pumps, rainfall directed away from cyanide storage bund to maintain bund storage volume, contingency ponds engineered and designed to hold cyanide spill. Fixed HCN monitoring, materials construction
Poor lake water quality	Acid run off from batters above the lake	Breach of mining consents	PLWQ model reviews Pit water monitoring programme

Risk		Potential Cause	Critical Controls
Not meeting closure criteria/ unacceptable for discharge	Level renders the lake water quality worse than predicted. Inaccurate water quality model. Water from underground backfill affects lake water quality.	Loss of mining licence More difficult for future permitting	Rehab & Closure Plan Updates Moss hydro seeding trial (completed) Geochemical testing of pit walls Closure assumption water to be treated and is budgeted. Trial on PAF bench of North Wall. Modelling of effect of backfilled working on pit lake water quality during consenting process.
Gas storage explosion in stores area / cylinder valve damaged leading to projectile.	Impact damage, Equipment failure, Incorrect storage and handling, deterioration	Personal injury Equipment damage Business interruption	Reorder points in PRONTO have been modified downwards Tag out and isolation, On the job training Signage Supplier refills and integrity check Preventive maintenance. Statutory inspection regimes Competency based training Visual inspection Restricted access Inspection of goods on arrival Appropriate lifting gear (certified) Inspection of gas storage area on weekly sheet Appropriate storage location Bollards Bottle trolleys to move cylinders Certified storage areas Audits/inspections (external / internal) Restricted Access
Hyprox 600 - Delivery, Storage and Use	Spillage contact with personnel	Personal injury or health effects	Automated process control system Automated re-order to prevent overfilling Bunding & drainage Preventative maintenance Tank Certification PPE

6 ROLES AND RESPONSIBILITIES

Role	Responsibility
General Manager	• Ensure that the HS - MP is understood by all personnel and used as the primary tool to manage risks/hazards associated with hazard substances. • Ensure that a system is in place and functioning for approving the use of all hazardous substances prior to the substance arriving on site. • Ensure there is a system for training all persons to access and understand Safety Data Sheets. • Ensure there is a training plan to achieve competency in handling hazardous substances. • Ensure that an audit of compliance to this standard is conducted at least every 3 years. • Final approval of any new hazardous substances.
HSE Manager (or delegate)	• Ensure all hazardous substances used are able to be handled safely at all times.

	• Manage the approval process for introducing new and or sample hazardous substances onto site • Monitor the training plan for achieving competency in handling hazardous substances. • Monitor expiry of Certified Handler's certificate for staff. • Ensure an SDS is available for all hazardous substances used on site, or if appropriate the risk assessment. • Monitor storage of all hazardous substances to ensure they are kept in approved storage areas. • Maintain the ChemAlert database.
Department Managers	• Act as the Person in Charge. • Ensure all hazardous substances used are able to be handled safely at all times • Manage the site location Compliance Certificates, and stationary container test certifications in their work area. • Keep the Waihi Operations approved hazardous substances list current. • Ensure the approval process for introducing new and or sample hazardous substances onto site is followed. • Conduct annual Hazardous substances audit.
Purchasing and Logistics Supervisor	Ensure all people involved in procurement understand: • Correct procedures for accepting delivery of hazardous substances; • Relevant emergency procedures; • Not to accept unlabelled hazardous substances containers; and • Ensure hazardous substances delivered are placed into approved storage areas upon delivery, with correct segregation. • Ensure all hazardous substances supplied and/or stock managed by a vendor is approved for use at Waihi Operations • Manage the stationary container test certification for diesel tanks
Principal's Representatives	• Ensure all contractor personnel are adequately trained in the safe handling and use of hazardous substances in your area of accountability. • Ensure any new substances proposed to be introduced are subject to the Product or Chemical Evaluation process. • Ensure contractors maintain a register of hazardous substances that is available on demand. • Ensure contractors have SDS's available on demand.
Superintendents, Foremen and Supervisors	• Ensure all hazardous substances are used according to the requirements of the SDS and any particular Standard Operating Procedures that may exist for the work being undertaken. • Ensure all hazardous substances used are able to be handled safely at all times
Plant Metallurgist	Provide technical advice to site personnel on specific hazardous substances and hazardous substances where and when requested.
Process Maintenance Supervisor	Manage the stationary container test certification for processing tanks.
Contractors	Comply with the requirements of this Standard and legislative requirements.

All Waihi Operations Employees and Contractors	• Follow instruction on SDS for all hazardous substances. • Do not bring any unapproved substances onto site. • Do not use unapproved substances. • Obtain appropriate approval using the Product or Chemical Evaluation Assessment Form

7 PROCEDURE

7.1 Process for a New or Change of Hazardous Substances

No hazardous substances are to be introduced to Waihi Operations without an assessment being carried out with approval from the Department and HSE Manager on the Product or Chemical Evaluation Assessment Form.

Priority is given (where possible) to sourcing alternative substances of a non-hazardous nature. Waihi Operations will pursue the reduction of hazardous substances used in the workplace and endeavour to use less hazardous substances where practicable and possible. Waihi Operations shall purchase hazardous substances suitable for use on site without the need for decanting and with appropriate labels already attached.

The product evaluation assessment will include:

1. Details – Intended use, frequency of use, application, amount, location
2. HSNO Classification – (Certified Handlers, triggers levels for legislative requirements etc)
3. Risk Assessment – assesses the level of exposure to personal, public, environment, storage, security
4. Controls – determines the controls to manage the risks
5. Other requirements – training, spillage requirements
6. An NZ-compliant SDS attached
7. Approval

If approved, the requesting person shall be notified to action the requesting process for the hazardous substances to be purchased and brought onto site. First aid items and personal protective equipment is to be available prior to use, along with ensuring appropriate legal and consent conditions are met. Training, information on safe handling, storage, emergency response, spillage control, waste disposal and environmental considerations must be obtained prior to use.

A register of hazardous substance is maintained in the ChemAlert database.

The Principal's Representatives, appointed to manage contractors, must ensure that all hazardous substances to be used by contractors are subject to the Waihi Operations hazardous substances approval process.

7.2 Hazardous Substance Register - ChemAlert

The ChemAlert database is used to record and maintain the register of hazardous substances / products used on site. Products are listed by Department, then Area, with the volume held. Once a hazardous substance is approved the suppliers/manufacturers SDS are provided to ChemAlert if it is not currently in the database. New products are analysed and a ChemAlert SDS. Suppliers/Manufacturers SDS are also available and linked in the database. ChemAlert SDS are colour rated, green, amber or red. Search functions allow for both of the general database and stockholdings is available along with a variety of reports. ChemAlert provides information on:

- Identification – Name, UN Codes, CAS number Storage location
- Suppliers/Manufacturers name
- Volumes - measurement
- Classification - Hazards
- Emergency – Information / response guide
- Reports – Manufacturers SDS, holdings, compatibility, labels, risk assessments
- Alerts – compatibility when adding a product/hazardous substance

NOTE: - Under current legislation we are not required to keep an inventory for consumer products used in amounts similar to domestic use. Contact the HSE team who will advise if a product doesn't need to be recorded in ChemAlert.

7.3 Safety Data Sheets (SDS)

The Supervisor and Department Manager must ensure that SDS are readily accessible to all employees potentially at risk from hazardous substances used or produced in the workplace and that any high risk (code red) substances have SDS available near the storage and or use of the substance. SDS hard copies are available in two locations (First Aid Room Mines Rescue Building and HSE Administrators Office) plus a copy is held by the Mines Rescue Team. SDS are to be within 5 years currency of issue date unless the product is deemed "obsolete" i.e. no longer being manufactured however is still in use. Colour risk rating system – Green (low) / Amber (medium) / Red (high).

7.4 Transportation of Hazardous Substances

The Waihi Operations and their contractors shall handle and transport dangerous goods in accordance with the Land Transport Rule – Dangerous Goods 2005 (when transported by road), and those substances shall be handled in accordance with the label and SDS directions applicable to that substance, including;

- Appropriate paperwork is completed prior to transport, and held by the driver
- Appropriate class placards shall be displayed whenever dangerous goods are transported.
- Appropriate Dangerous Goods endorsements will be held by drivers
- Appropriate license classes will be held by the driver, appropriate to the weight/class of vehicle used
- Regular audits will be carried out to ensure compliance with this.

7.5 Labelling of Hazardous Substances

A person who supplies a hazardous substance for use at a Waihi Operations site must ensure that any container of the hazardous substance is appropriately labelled in accordance with the Hazardous Substances (Identification) Regulations 2001 and that the label is not removed, defaced or altered. The user must ensure that any such label:

a) clearly identifies the hazardous substance;
b) sets out the name, address and telephone numbers (including the 24 hour emergency number), of the NZ distributor or supplier (refer Hazardous Substances (Identification) Regulations 2001);
c) discloses the hazardous substances name of each type I ingredient;
d) discloses the hazardous substances name of each type II ingredient or, if the identity of the ingredient is commercially confidential, its generic name; and
e) provides basic health and safety information about the substance, including any relevant risk phrases and safety phrases.

NOTE: - If the container to be labelled is so small that it is not practicable to include all the particulars it is sufficient if the label complies with a) and b).

A container into which a hazardous substance is decanted for use within the next 12 hours (continuous) needs only be labelled with the product name and the relevant risk phrases and safety phrases and a container into which a hazardous substance is decanted for immediate use need not be labelled, so long as it is cleaned immediately after it has been emptied of the substance.

7.6 Storing Hazardous Substances

The Waihi Operations shall store and require its contractors to store, while on a OceanaGold controlled Operations site, hazardous substances according to the requirements of the relevant Legislation, Codes, Standards and Safety Data Sheet (SDS). No product shall be used or brought onto an OceanaGold controlled site until a current Safety Data Sheet is available for the product (i.e. the date shown on the SDS should ideally NOT be older than five years).

The SDS must be readily accessible at the point of storage, usage or decanting for all high-risk chemicals.

Storage areas are to be constructed according to applicable Australian and/or New Zealand Standards. For example: AS 1940 - Storage and Handling of Flammable Substances and Dangerous Goods; and AS/NZS 1841 (Set) - Portable Fire Extinguishers.

Hazardous Substances storage areas and entrances to the site and buildings shall include signage appropriate to the class of substance being stored and/or used in that area.

Stored hazardous substances must be adequately segregated based on:

- Quantity of materials stored
- Physical state of the chemicals (solid, liquid or gas)
- Degree of incompatibility (report available from ChemAlert)
- Manufacturer's instructions; and
- Known behaviour of the materials.

All bunded compounds will be maintained to ensure;

- Bunding in compliance with AS1940 – 2009
- Secondary containment capacity of at least 110% of the largest container
- Chemical resistant to the substance stored
- Valves, pumps and meters associated with transfer are operable as required
- Equipment is adequately protected and contained
- Any potential jetting from any storage vessel or fitting is captured within the bunded area; and
- Incompatible chemicals are physically segregated and do not come into contact with each other

7.7 Signage

Signage will be maintained at all entrances to site as per the HSNO requirements to ensure that people (including emergency services) entering site understand the hazards posed by the substances and take the appropriate precautions. Entrance, area and storage tank signage is to identify the substance present, the class and action to be taken in an emergency. Additional signage for tanks (LPG, liquid oxygen, hydrochloric acid, diesel and sodium hydroxide) require signage to include: proper shipping name, UN number, relevant HAZCHEM code, other applicable warnings (eg degree of the hazard, if combustible, highly toxic, highly corrosive, no smoking, no ignition sources etc).

7.8 Storage Tanks and Piping

Storage tanks and piping must be certified and approved for the conditions of use and be made of suitable material to be impervious to the chemical stored in them. They are to be stored above ground and routinely inspected and maintained. The only exemption (LPG Line under roadway) requires specific integrity testing.

Piping and flow lines shall be colour coded and marked to indicate the content and direction of flow. Fluids will be labelled in accordance to ASNI/ASME A13.1. Gases will be labelled in accordance to AS/NZS 5807.

7.9 Automated Plant Control Systems

Automated plant control systems will be in place where possible to safeguard personnel and property. Hazardous substance bulk storage will be fitted with level instruments where possible which feedback to a central PLC SCADA system. The SCADA is continuously monitoring and displays the information to operations on a human machine interface (HMI). Where possible control interlock's will be in place to prevent any inadvertent release of chemicals. The event of an emergency stop or power failure the hazardous substances storage, dosing, delivery system will shut down into a fail-safe position. All valves will be fail close unless defined by a risk assessed design or change management. Alarm parameters will be set when monitoring instrumentation is installed. The alarm conditions are monitored through the SCADA and on activation will be audible and visual. All alarms must be acknowledged by operations.

7.10 Mixing and Distribution Systems of Hazardous Substances

Critical to the safe use of hazardous substances is the confidence that the systems implemented for mixing and distribution be designed, constructed and maintained to an appropriate standard. This equipment must be assessed on the Hazard/Risk matrices and appropriate controls implemented to minimize any potential exposure to the hazardous substances. It must also meet all legal requirements.

7.11 Using Hazardous Substances

In addition to the expressed requirements of relevant legislation and standards pertaining to the use of hazardous substances Waihi Operations and its contractors shall also use hazardous substances according to directions given on the SDS that applies to the substance. The SDS shall be made readily available for personnel for reference purposes.

Where chemicals identified as hazardous substances are handled in the workplace, employee exposure to these substances must be eliminated or minimised through the hierarchy of controls and the appropriate controls implemented.

Hazardous substances used in confined spaces must conform to AS/NZS 2865 - Safe Working in a Confined Space.

Any substance found to be incorrectly stored must be reported.

7.11.1 *Personal Protective Equipment & Emergency Showers/Eye Wash Stations*

PPE will be selected and used in accordance with site PPE procedure. Correct PPE signage is to be installed and maintained in all areas where chemicals identified as Hazardous Substances are stored or used. PPE is selected with regard to likely permeability, penetration, resistance to damage and compatibility with work tasks.

Eye-wash stations and safety showers are placed in areas where there is a high likelihood of eye contact with chemicals and/or airborne particles. Solutions in eyewash stations are to be kept in date and replaced as expired. Safety showers are regularly tested to ensure they are in working condition and may be alarmed to ensure that other personnel become aware if a person has had to use a shower.

7.11.2 *Spill Response*

Spill response kits shall be made available in all work areas where hydrocarbons and other substances may require containment and clean up. Training is provided to employees who need to conduct spill recovery and clean-up.

7.11.3 *Certified Handlers*

The site has Certified Handlers for hazardous substances stored in quantities exceeding those referred to in the relevant Schedules of the Hazardous Substances (Classes 1 - 5 Controls) Regulations 2001 and/or Hazardous Substances (Classes 6, 8 & 9 Controls) Regulations 2001 Requirements.

A register of Certified Handlers and their certificates is maintained in the site training database Intuition.

7.12 Disposing of Hazardous Substances

The HSE Manager or delegate shall be notified prior to any disposal of hazardous substances. Disposal requests are to be submitted on the Chemical Disposal Form. Disposal shall be in accordance with the relevant OceanaGold Compliance Standards, and Regional and Local authority requirements.

Each department is responsible for disposing of chemicals produced by normal process activities and those, which may arise, from accidental leaks and spillage.

Intermediate Bulk Containers (IBC's) that have been used to hold dangerous goods shall be disposed of according to site procedures, or if being removed from site for recycling, will be cleaned as per site requirements, and the labelling removed to identify that they no longer contain the dangerous goods.

7.13 Workplace Occupational Health Monitoring

Workplace health monitoring is carried out on all employees based on the health risk assessment. This includes both medical assessment, biological and air quality monitoring programs where a risk assessment or health assessment has determined that there is a significant risk to their health as a result of such exposure to a chemical substance, sampling and monitoring is carried out. This monitoring shall be carried out in line with the details in the Worker Health – PCP and occupational hygiene monitoring program.

7.14 Location Compliance Certificates

The HSE Department organises the annual Location Compliance Certificate for site with exception of Class 1 explosives. The Underground and Surface Mining are responsible for obtaining authorisation for their annual Class 1 and associated substances Location Compliance Certificate.

Copies of the Location Compliance Certificate is held in S/Drive/Safety/HSNO.

7.15 Stationary Container Compliance Certificates

A spreadsheet of tanks is located in S/Drive/Safety/HSNO along with copies of all stationary container certificates.

Diesel tanks Compliance Certificates are managed by the owner and supplier of fuel with copies sent to site to the company representative.

Processing tanks container Compliance Certificates are managed by the Maintenance Supervisor who maintains a file for each tank with all the relevant information on design and testing etc and the tank certificate.

8 CRITICAL CONTROLS

To ensure that the risk of incidents occurring is minimised, the following critical controls are in place at Waihi:

- Standard operating procedures for working with high risk chemicals, including emergency response
- Staff training in use the chemicals
- Safe work practices, including good housekeeping and regular cleaning of work areas
- Inventory checking and prompt disposal of hazardous chemicals that are no longer required
- Keeping containers of hazardous chemicals appropriately bunded and segregated
- Spill kits are available to clean up spills immediately
- Provision of washing facilities for rinsing off chemicals (e.g. hand washing, eye-washes safety showers)
- Appropriate chemical-resistant gloves must be selected in relation to the chemical being handled Some gloves may be resistant to certain substances but may break down or even react with others
- Using full-face respirators rather than a half-face respirator, and chemical splash suits during any high-risk chemical mixing operations which can cause skin and respiratory allergic reactions

9 EMERGENCY RESPONSE

The Emergency Management Principal Control Plan (EMP) sets out the requirements for any emergency at Waihi and includes Trigger Action Response Plans (TARPS) in case of emergency to cover a chemical incident such as medical or spillage.

Copies of the site EMP along with familiarization visits are provided to the local emergency services to assist with response to an emergency.

The Safety Appliance Map is placed around site and is included as an appendix to this document and the Emergency Management Principal Control Plan and includes the location of fire extinguishers (including type), fire hoses, hydrants, breathing apparatus, fire alarms, safety showers etc.

The mines rescue team are trained to a higher level in chemical management of emergencies. All team members are required to hold a formal qualification to unit standard for responding to hazardous chemical emergency.

9.1 Evacuation Drills – for Location Compliance Certificate

Evacuation Drills are required to be carried out to meet the Emergency Management requirements of the Location Compliance Certificate for HSNO. Regulations require evacuation testing for each substance annually, however the Compliance Certifier has accepted three evacuations (one each for fire, spill and acid) per year on the proviso evacuation for all substances are carried out once every two years. Monitoring completion is recorded in the Evacuation Drill register.

- LPG – both fire and leak
- Hydrogen Peroxide – practice / first aid
- Activated carbon – fire
- Hydrochloric acid or sodium hydroxide – spill to ground (eg into waterways) use first aid – this could be anyone of the acids.
- Cyanide
- Cryogenic (liquid oxygen)

10 MONITORING, REVIEW AND AUDIT

10.1 Monitoring

In order to monitor the implementation and effectiveness of this PHMP a Critical Controls Check Sheet has been developed from the critical controls listed on this management plan. These are to be completed by the Department Manager (or their delegate) responsible for this Hazard on a yearly basis then presented to the SSE for final sign off. All corrective actions identified are to be entered into INX system which will track them until completion.

10.2 Review

This PHMP and its associated risk assessment(s) will be reviewed:

- After an incident that involves the hazard
- After a substantial change in the management structure that may affect the management plan
- After a physical change in plant used or installed at the mining operation that may affect the management plan
- Or at least every 2 years, whichever occurs first.

10.3 Audit

Annual Compliance Certificates are issued for the Site by an external accredited Compliance Certifier.

An internal audit will be carried out every three years to ensure compliance.

11 CORRECTIVE ACTIONS

Non-compliances with this management plan will be identified through incident or hazard reports, reviews and audits. All non-compliances identified will be investigated and corrective actions will be entered into the INX system which will be tracked until completed.

12 TRAINING

All employees shall be provided with training, information, and instruction appropriate to the level of risk associated with a task using a hazardous substance.

Supervisors shall ensure every worker who uses, handles, manufacturers or stores hazardous substances are competent in the safe use, handling and disposal of substances prior to assigning work tasks involving hazardous substances.

Training shall include:

- Information re the operations of the workplace where hazardous substances may be present
- Location of reference material on the hazards, safe handling, storage and disposal within the workplace;

a. Reading and understanding the relevant Standard Operating Procedures (SOP)
b. Reading and interpretation of material safety data sheet (SDS) contents

- Practice in the safe use of plant including PPE necessary to manage the risks
- The physiochemical and health hazards associated the hazardous substances the worker uses at work
- The actions that the worker must take in an emergency involving hazardous substances
- Workers obligations under the regulations

Certified Handler training for any staff handling Class 6.1A and 6.1B – other than those working under the direction of a Certified Handler. Ensure sufficient approve handlers are trained to cover shift absences.

13 DEFINITIONS

Term/Word	Meaning
ALARP	As Low as Reasonably Practicable
Certified Handler	A person who holds a compliance certificate that indicates that person has competency as a certified handler (ref Reg 4.3). Previously known as Approved Handler.
Change Management	The process used to assess and assimilate all internally and externally driven changes in a routine but methodical fashion.
ChemAlert	OceanaGold's Chemical Data Base administered by the Health and Safety Officer. It can be used to look up the SDS of a chemical and to track approved chemicals and storage locations at site.
Compliance Certificate	A certificate issued by a compliance certifier (Reg Sub part of Part 6). Previous know as Test Certificate.
Consumer Product	Means a hazardous substance that is packed or repacked for use by a household consumer for use in an office and is packed in a way and quantity in which it is intended to be used in an office.
Competent Person	For any task means a person who has acquired through training, qualification or experience, or a combination of them, the knowledge and skills to carry out that task.
Controlled Substance Licence	A licence issued by Worksafe NZ under Part 7
Continuous Improvement	The process of enhancing a process, system or item, to achieve improvements in overall safety, performance, reliability, serviceability, efficiency, cost or other parameter in line with OceanaGold's management philosophies.
Dangerous Good	Means substances or articles having the properties described in the Land Transport Rule, Dangerous Goods 2005 Rule 45001/1 - Table A: Properties and classification of dangerous goods for land transport, and substances or articles declared by the relevant authority to be dangerous goods for transport on land; and includes any packaging and empty containers that have been cleaned after containing dangerous goods.
ERMA	Environmental Risk Management Authority
Event	Realisation of a hazard
External audit	An audit in which the lead auditor, at the least, has no constant operational ties to the mine
Hazard	That which has the potential to cause harm or damage

Term/Word	Meaning
Hazardous Substance	Is the legal term for substances regulated by New Zealand's Hazardous Substances and New Organisms Act 1996 (HSNO Act). Means, unless expressly provided otherwise by regulations, any substance a) With one or more of the following intrinsic properties: i. Explosiveness ii. Flammability iii. A capacity to oxidise iv. Corrosiveness v. Toxicity (including chronic toxicity) vi. Eco toxicity, with or without bioaccumulation, or; b) Which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any 1 or more or the properties specified in paragraph (a). Health & Safety at Work Hazardous Substances Regulations 2017 In these regulations, unless the context otherwise requires, hazardous substances- a) has the same meanings as in section 2(1) of the HSNO Act, as that meaning is modified by sub clause (2); but b) does not include food, but includes a food additive and c) does not include medicine, but includes new medicine that is treated as hazardous under the HSNO Act and d) does not include a psychoactive substance that is treated as not hazardous under the HSNO Act. In this regulation – adopted joint food standard has the same meaning as in section 397 of the Food Act adopted joint food standard has the same meaning as in section 397 of the Food Act 2014 food— a) has the same meaning as in section 9 of the Food Act 2014; but b) does not include a food additive food additive means a substance that— (a) is identified in an adopted joint food standard as a substance intended to be mixed with or added to any food or drink; and (b) has not been so mixed or added
HSMP	Hazardous Substances Management Plan.
Internal audit	An audit conducted by mine personnel.
Label	A set of information on a container which: a) identifies the substance in the container; b) identifies whether the substance is hazardous; and c) provides basic information about the safe use and handling of the substance.
Person in Charge	The person who is in control of the place where hazardous substances are present e.g. Department Manager.
Risk	The risk of injury or illness to a person or damage to equipment arising out of a hazard.
RA **(Risk Assessment)**	A Risk Assessment is the process of determining the likelihood and consequence of a specific negative event (or risk).
Risk Phrase	These are the risk definitions used in the ChemAlert system

Term/Word	Meaning
SDS (Safety Data Sheet)	A document providing information to help users develop correct occupational hygiene and safety procedures and exercise the required degree of care. An SDS: a) identifies the substance and its use; b) describes the chemical and physical properties of the substance; c) provides health hazard information and precautions for use and safe handling; and d) incorporates all the legislative requirements as well as additional safety information
Substance	a) Any element, defined mixture of elements, compounds, or defined mixture of compounds, either naturally occurring or produced synthetically, or any mixtures thereof; b) Any isotope, allotrope, isomer, congener, radical, or ion of an element or compound which has been declared by the Authority, by notice in the Gazette, to be a different substance from that element or compound; c) Any mixtures or combinations of any of the above; d) d) Any manufactured article containing, incorporating, or including any hazardous substance with explosive properties.
SWI	Safe Work Instrument Reg 11- an obligation imposed by a referring provision on a PCBU or other person to comply or ensure compliance with a SWI is to be treated as an obligation to comply or ensure compliance. They are a subordinate instrument or tertiary legislation. They are enforceable if referenced in a Regulation.
TARP	Trigger Action Response Plan
WES	Workplace Exposure Standards or biological exposure standards index that has the purpose of protecting persons in the workplace from harm to health.

14 ASSOCIATED DOCUMENTS

Product or Chemical Evaluation Assessment Form	Sharepoint
Chemical Disposal (Form)	Sharepoint
Critical Control Check Sheet	Sharepoint
Safety Appliance Map – Processing	Sharepoint / work areas
Safety Appliance Map – UG Area	Sharepoint / work areas
Location Compliance Certificates	S Drive:Safety:HSNO
Certified Handler Training Certificates	INX - Intuition
Certified Handler register	INX - Intuition
Emergency Management Plan	Sharepoint – hard copies as per document

15 APPENDICES

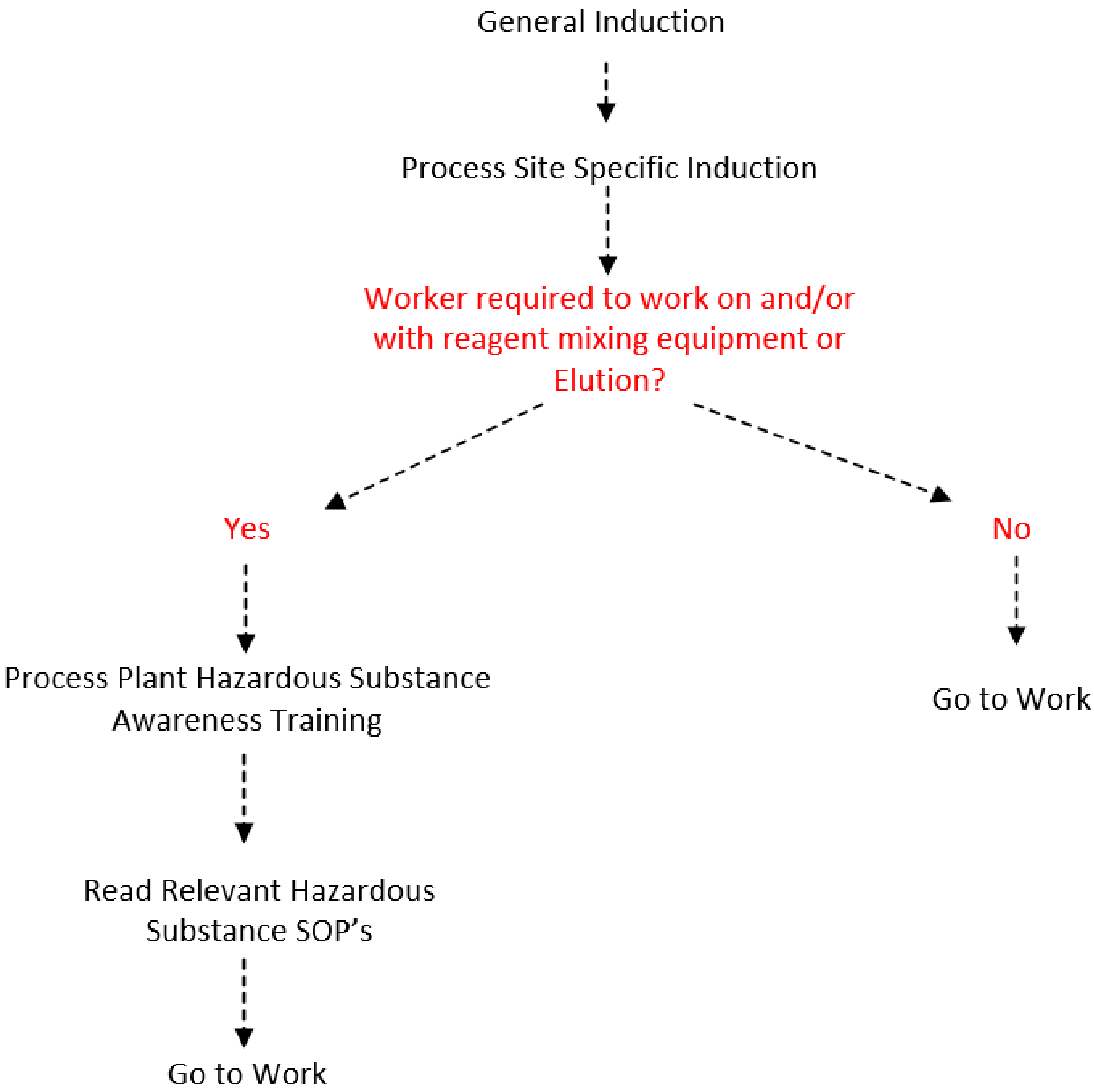
Note: Information required by the Compliance Certifier for renewal of the Location Compliance Certificate is also included as appendices.

15.1 Supporting Documents

The following Standard Operating Procedures, Management Plans and Site Standards are managed electronically on the OGNZL intranet document control centre and/or equivalent contractor document control systems:

Document Name	Type	Owner	Department
General Safety			
General Induction	Induction	OGNZL	HSE
Job Hazard Analysis	Standard	OGNZL	HSE
Waihi Risk Management Standard	Standard	OGNZL	HSE
Waihi Risk Register	Register	OGNZL	HSE
Processing			
Waihi Cyanide Management Plant	Plan	OGNZL	Processing
Radiation Safety Plan for Industrial Gauging	Plan	OGNZL	Processing
Bulk Sodium Cyanide Transport Delivery and Unloading	SOP	OGNZL	Processing
Bulk Cyanide Delivery Checklist	Checklist	OGNZL	Processing
Sodium Cyanide Transport Delivery Unloading and Mixing Security	SOP	OGNZL	Processing
Hydrochloric Acid Product Delivery	SOP	OGNZL	Processing
Hydrogen Peroxide Product Deliver	SOP	OGNZL	Processing
Liquid Oxygen Product Delivery	SOP	OGNZL	Processing
Carbon Dioxide Product Delivery	SOP	OGNZL	Processing
Radiation Safety Plan for Industrial Gauging	SOP	OGNZL	Processing
Sodium Hydroxide Product Delivery	SOP	OGNZL	Processing
Sulphuric Acid Product Delivery	SOP	OGNZL	Processing
Ferric Chloride Product Delivery	SOP	OGNZL	Processing
WTP Reagent Dosing	SOP	OGNZL	Processing
Process Plant LPG Delivery	SOP	OGNZL	Processing

15.2 Processing Worker Hazardous Substance Training Flowsheet



15.3 Product Evaluation Form

Product or Chemical Evaluation Assessment Form

OCEANAGOLD

PRODUCT NAME :		SUPPLIER :	
REQUESTED BY :		DEPT	LOCATION:
INTENDED USE (change in use):		APPLICATION METHOD :	
FREQUENCY OF USE:	NO OF CONTAINERS:	CONTAINER SIZE:	L / kg

HSNO – Classification Information can be obtained from either the NZ suppliers SDS, Reports on S Drive/Safety/HSNO or ERMA website or ask the HSE Dept. or an Approved Handler to complete.
Note: We legally require a NZ compliant SDS – please ensure you obtain from your supplier before sending for approval.

Classification (e.g. 3.1B, 6.4A etc)				
Is this a tracked substance: If Yes are systems setup to track this product	Yes		No	
Approved handler needed?	Yes		No	
Are Approved handlers licensed for the classes?	Yes		No	
Amount currently on site:				L / kg
HSNO Trigger Level (i.e. will this change signage, secondary containment, emergency plans?)				L / kg

Location Test Certificate covers trigger level? Yes No Certificate/Approval required

Risk assessment - using the HSNO classes, assess the level of exposure for the following (or SDS)

Health Effects – eyes, inhalation, skin	Extreme	High	Moderate	Low
Public safety	Extreme	High	Moderate	Low
Environmental impact – soil, water, air, biota	Extreme	High	Moderate	Low
Property damage	Extreme	High	Moderate	Low
Storage Details – transportation, fire/explosion	Extreme	High	Moderate	Low
Security – assess the level of security required for product	Extreme	High	Moderate	Low
Overall Level of Hazard	Extreme	High	Moderate	Low

Controls - given the above, determine the best option for managing the risk(s)

Eliminate	Substitution	Minimise	Isolate	PPE	SOPs/Signage

Which engineering controls / process controls are required to minimise the risks?

Ventilation – opened	Extra lighting	Warning Signs	Written Procedures
Ventilation – forced	Barriers/Guards	Fire Extinguisher	Atmospheric monitoring
Additional Training	Other :		

What special personal protective equipment should be worn?

Particulate dust mask	Splash proof goggles	Half face respirator	Full Face Respirator
Disposal coveralls (Apron)	Full Face Shield	Air Supplied Respirator	Special glove
Standard Rubber Gloves	Other:		

Are there appropriate spillage containment facilities available? Yes No	*Are any exposure standards likely to be exceeded (if applicable) Yes No*
Training in the use of this product has been planned Yes No	

APPROVAL TO USE PRODUCT

Recommendations/Actions Required:

Departmental Manager		Date:	
Snr Environmental Advisor		Date:	
HSE Manager		Date:	
HSEC Administrator – Update ChemAlert		Date:	

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15.4 Risk Matrix

Consequences	1	2	3	4	5
People	First aid *(Insignificant consequences)*	Medical treated injury *(Minor consequences)*	Lost time or restricted work injury/illness (< 2 weeks) *(Moderate consequences)*	Serious lost time injury/illness (>2 weeks) or permanent disabling injury *(Major consequences)*	Single or Multiple fatalities *(Catastrophic Consequences)*
Environmental	No measurable impact, minimal clean-up. Uncontrolled discharge <40L	Low impact over a small area, contained on Site, minor clean-up completed within 24 hours.	Measurable impact contained on Site or low impact off Site, clean up requiring 7 days.	Measurable serious impacts, significant clean up and rehabilitation to 30 days.	Measurable long term impacts, Extensive clean up and rehabilitation >30 days
Financial	< $5,000 (Operational) <$50, 000 (OGC)	$5,000 – $20,000 (Operational) $50, 000 - $1,000,000 (OGC)	$20,000 - $200,000 (Operational) $1M - $5M (OGC)	$200,000 - $1,000,000 (Operational) $5M –$20M (OGC)	>$1,000,000 (Operational) > $20M (OGC)
Reputation	Local media inquiries based on performance and technical breaches of licences. Small numbers of sporadic complaints.	Adverse local media coverage and local discontent due to complaints. General queries from Regulators	Adverse media coverage at local and regional level. Potential negative effect on investor sentiment. Consistent and repeated high level complaints.	Adverse local, regional and national media coverage. High level of concern or complaints	Adverse national media coverage with international interest and sustained/ widespread high level of concern or complaints.
Compliance	Minor technical or legal compliance issue unlikely to attract a regulatory response	Breach with potential for low level regulatory action including infringement penalties.	Breach resulting in investigation, repeated no-impact non-compliances. Likely potential for prosecution or enforcement action	Breach resulting in investigation and almost certain prosecution. Operational activities suspended.	Non-compliance events resulting in investigation and almost certain prosecution. Operation suspended, licences revoked.

Likelihood	1	2	3	4	5
A Common — Happens often, is likely to happen again, has a high frequency of occurrence.	11	16	20	23	25
B Likely — Is likely to occur, known to happen, expected more than once in a year period.	7	12	17	21	24
C Possible — It could occur, has occurred or expected within a 1 to 5-year time period.	4	8	13	18	22
D Unlikely — Not expected to occur, has occurred or could occur once within a 5 to 10-year time period.	2	5	9	14	19
E Rare — Has rarely occurred in the industry, not expected to within the next 10 years.	1	3	6	10	15

Risk Acceptability and Management Table

Risk Level	Score	Management Method
Low	1 – 5	Employee to manage through Stop and Think, stopping when the task becomes unsafe or employee unsure. Regular checks in field by Supervision and task observations by leaders.
Medium	6 – 12	Manage through JHA's, procedures, work instructions, task observations, Supervisors/Superintendents to sign off on JHA's prior to work commencing. Monitored through increased supervision, task observations.
High	13 – 20	Manage through Principal Hazard Plans, procedures, work instructions, Permit to Work approved by Department Manager. JHA's when required by Plans, Procedures and Work Instructions may be signed off by Superintendents or persons authorised by the GM. Where a JHA is working outside the plans and procedures, sign off by the Department Manager or Superintendent is required. Work is to be monitored through increased supervision, task observations, inspections, reviews and audits.
Extreme	21 – 25	Formal Risk Assessment is required to understand and more effectively manage the risk. All work to be reviewed and signed off by General Manager of Business Unit.

15.5 Site Risk Register

The site Waihi Risk Register is a live document located in the Dept Head G Drive. A copy is published to OceanaGold's Global Intranet, SharePoint at a minimum of 6 monthly or whenever any major changes.

https://oceanagold.sharepoint.com/waihi/environment/Pages/Risk-Management.aspx

Risks associated with hazardous substances have been extracted from this register and included in this document on the following pages.

					Inherent Risk (Absent or failed controls/defences)						Impacted Areas (Maximum reasonable consequence)							Residual/Current Risk (controls present and applied)			
Risk #	Department (Site wide available)	Risk Description (What can happen)	Potential Cause(s) (How / why might it happen?)	Principal Hazard Impacts	Consequence (Credible worst case)	Likelihood	Risk Level		Critical Controls	Current Controls	Health and Safety	Environmental	Social	Financial	Reputation	Compliance	OceanaGold Standard	Consequence (Maximum reasonable case)	Likelihood	Risk Level	
WRR-0142	Processing	Chemical Exposure	Pipeline failure Spillage Delivery errors System failure Lack of knowledge / training Failure to wear appropriate PPE Failure to follow procedures Overflow Tank failure	Lost time Injury Equipment damage Business interruption	4	C	18	High	SOP's Approved handlers Hazchem Awareness training Supervision PPE Engineering controls Secondary containment Bunding External audits Equipment inspections and maintenance Safety showers Eye wash Signage HSNO certification Mines Rescue team First aid training Chemical specific training Induction / assessment training of delivery drivers Liaison with chemical suppliers Specialised cleaning contractor Closure plan Cyanide decontamination plan Audit of structure - concrete Cyanide code compliance Diphoterine Planned maintenance Fixed and personal gas monitors Permit to work systems	SDS	3	3					8.9 Hazardous Materials and Chemical Substances	3	D	9	Medium
WRR-0242	Processing	Radiation exposure	Fire Dropped/damaged device	Uncontrolled release of radioactive material Personnel exposure to radiation	1	E	1	Low	Radiation Management Plan Minor quantities of radioactive material kept on site for density gauges Internal Auditing Signage Radiation Safety Officer & Principal Licensee Inspections & monitoring Protective housing (engineered to withstand fire, falls, and explosions) Training	National Radiation Laboratory Audits & Licensing	1						8.9 Hazardous Materials and Chemical Substances	1	E	1	Low
WRR-0476	Processing	Hydrochloric Acid - Delivery, Storage and Use	Spillage, contact with personnel	Personal injury or health effects	3	E	6	Medium	Isolation - Bunded Storage, Splash guards for pumps, pipes Engineering - Scrubber, Tank Certification. Process automation & instrumentation, bunging, drainage and sump pumping, Automated re-order to prevent overfilling, Materials of construction, Locked delivery point with unique key, Preventative Maintenance PPE - Splash proof goggles, rubber gloves (full length) Rubber boots,	Administrative -Delivery drivers training, delivery checklist, inductions, manuals, SOP's audits, HSNO compliance, Diphoterine, Emergency PPE boxes located near reagent filling points.	3						8.9 Hazardous Materials and Chemical Substances	3	E	6	Medium

					Inherent Risk (Absent or failed controls/defences)						Impacted Areas (Maximum reasonable consequence)							Residual/Current Risk (controls present and applied)			
Risk #	Department (Site wide available)	Risk Description (What can happen)	Potential Cause(s) (How / why might it happen?)	Principal Hazard Impacts	Consequence (Credible worst case)	Likelihood	Risk Level		Critical Controls	Current Controls	Health and Safety	Environmental	Social	Financial	Reputation	Compliance	OceanaGold Standard	Consequence (Maximum reasonable case)	Likelihood	Risk Level	
WRR-0477	Processing	Hyprox 600 - Delivery, Storage and Use	Spillage, contact with personnel	Personal injury or health effects	4	E	10	Medium	Automated process control system Automated re-order to prevent overfilling Bunding & drainage Preventative maintenance Tank Certification PPE HSNO Compliance Task SOP's	Delivery Drivers trained by supplier Delivery checklist Inductions (general & Specific) Area Manuals Audits (Internal & External)	4						8.9 Hazardous Materials and Chemical Substances	4	E	10	Medium
WRR-0478	Processing	Sodium Cyanide - Delivery, Storage and Use	Spillage, contact with personnel	Personal injury or health effects	5	E	15	High	Cyanide storage area inside bunded shed. Bunded containment to prevent spill escaping to the workplace or environment. Cyanide facility and pipework away from acids, no possible way for acids and cyanide to interact Scrubber on solids mixing tank, automated control systems, interlock control systems to prevent tank overflows, overflows pipework to bund to catch any possible overflow, bund has sump pump rain fall re-directed away from cyanide storage bund to maintain bund storage volume. Fixed HSN monitoring, Materials construction, PPE	Waihi Cyanide management Plan HSNO compliance Delivery checklists, area manuals, task SOP's, cyanide awareness training, audit, inductions, security checks 24/7,	5						8.9 Hazardous Materials and Chemical Substances	5	E	15	High
WRR-0479	Processing	Sodium Cyanide Solution (30%) - Storage and Use	Spillage, contact with personnel	Personal injury or health effects	5	E	15	High	Bunded area, splash guards around pipes, flanges, pumps. Cyanide facility and pipework away from acids with no possibility of acids and cyanides interacting. Cyanide storage and mixing area pipework completely dedicated. Pipework isolated completely from water network. Automatic mixing, transfer dozing, automatic control systems, interlocked control systems to prevent tank overflows, bunded areas with sump pumps, rainfall directed away from cyanide storage bund to maintain bund storage volume, contingency ponds engineered and designed to hold cyanide spill. Fixed HCN monitoring, materials construction	Waihi Cyanide Management Plan, Cyanide 33% liquid colour with red dye for identification, mixing checklists, area manuals, task SOPs, cyanide training awareness, security checks 24/7 on area, cyanide poisoning antidote held onsite	5						8.9 Hazardous Materials and Chemical Substances	5	E	15	High
WRR-0480	Processing	Caustic Soda - Delivery, Storage and Use	Spillage, contact with personnel	Personal injury or health effects	3	E	6	Medium	Stored in bunded area, splash guards in place around pipes, tanks and pumps, HSNO segregation/ compatibility requirements, automated re-order to prevent overfilling, bunding, drainage and sump pump, materials of construction, tank certification, process automation & instrumentation, preventative maintenance program, delivery point locked with unique key	delivery drivers trained, delivery checklist, area manuals, task SOP's, PPE	3						8.9 Hazardous Materials and Chemical Substances	3	E	6	Medium

					Inherent Risk (Absent or failed controls/defences)						Impacted Areas (Maximum reasonable consequence)							Residual/Current Risk (controls present and applied)			
Risk #	Department (Site wide available)	Risk Description (What can happen)	Potential Cause(s) (How / why might it happen?)	Principal Hazard Impacts	Consequence (Credible worst case)	Likelihood	Risk Level		Critical Controls	Current Controls	Health and Safety	Environmental	Social	Financial	Reputation	Compliance	OceanaGold Standard	Consequence (Maximum reasonable case)	Likelihood	Risk Level	
WRR-0544	Processing	Health Exposure to Ionising Radiation	Equipment failure, Failure to follow procedures, Equipment housing damage	Medically treated Injury Lost time Injury Permanent Disabling Injury Nervous system illness	4	C	18	High	Radiation seals / enclosed shielding. Low quantities of radioactive material kept on site for density gauges. Warning signage. Restricted work zones & distance. Radiation Inspections & monitoring Protective housing (engineered to withstand fire, falls, and explosions) WAI-253-FOR-003 Radiation Safety Plan for Industrial Gauging WAI-470-PRO-003 Radiation Permit and Work procedure. WAI-470-FOR-003 Radiation Permit WAI-457-PRO-001 Wipe test on fixed Radiation Gauges WAI-250-PLN-002 Worker Health Principle Control Plan	Radiation Safety Officer & Principal License Holder. Site Induction Information. Process Mill Induction & area familiarisation. Stop & Think and JHA process. Toolbox Meetings. Work Area inspections. Task Observations.	4						8.9 Hazardous Materials & Chemical Substances	4	E	10	Medium
WRR-0250	Mining - Surface	Radiation sources	Fire Damage by heavy construction equipment	Uncontrolled release of radioactive material due to housing damage Personnel exposure to radiation	1	E	1	Low	Radiation Management Plan Minor quantities of radioactive material kept on site for density gauges National Radiation Laboratory Audits & Licensing Internal Auditing Signage Site has appointed Radiation Safety Officer & Principal Licensee Inspections & monitoring Protective housing (engineered to withstand fire, falls, crushing, and explosions) Training		1						8.9 Hazardous Materials and Chemical Substances	1	E	1	Low
WSW-11	Site Wide	Health Radiation - ionising (alpha, beta, neutrons, gamma, x-ray)	Skin damage Blood Changes Sterility Genetic Defects Cancer	Long term illness, carcinogenic	5	E	15	High	Restricted area / access Sealed gauges	Radiation training and induction Radiation Permit before commencing work Radiation Register Radiation sources sign-posted Wipe test External Audits Radiation officer Regular Maintenance Program	2						8.9 Hazardous Materials and Chemical Substances	4	E	10	Medium

Risk #	Department (Site wide available)	Risk Description (What can happen)	Potential Cause(s) (How / why might it happen?)	Principal Hazard Impacts	Inherent Risk (Absent or failed controls/defences): Consequence (Credible worst case)	Inherent Risk: Likelihood	Inherent Risk: Risk Level		Critical Controls	Current Controls	Impacted Areas (Maximum reasonable consequence): Health and Safety	Environmental	Social	Financial	Reputation	Compliance	OceanaGold Standard	Residual/Current Risk (controls present and applied): Consequence (Maximum reasonable case)	Likelihood	Risk Level	
WRR-0043	Site Wide	Onsite spill during delivery of reagents - spill not contained on site causing community outrage.	Vehicle collision - accident Tank failure Packaging failure Driver / delivery procedure error	negative community reaction	4	E	10	Medium	Contractor management Contractor audits / inspections Certified Suppliers Designed fit for purpose transport & storage vessels Ponds and Bunding MSDS on site MRT trained in chemical spill events Comms integral to CIMS Regular site visits by emergency services Comms to address inaccurate perceptions of possible event HSNO Act Compliance Audit internal/external findings Management inspections Community perception of site		4	4	4	4	4	4	8.9 Hazardous Materials and Chemical Substances	4	E	10	Medium
WRR-0105	Site Wide	Gas storage explosion in stores area / cylinder valve damaged leading to projectile.	Impact damage, Equipment failure, Incorrect storage and handling, Deterioration	Personal injury Equipment damage Business interruption	4	E	10	Medium	Reorder points in PRONTO have been modified downwards Tag out and isolation On the job training Signage Supplier refills and integrity check Preventive maintenance Statutory inspection regimes Competency based training Visual inspection Restricted access Inspection of goods on arrival Appropriate lifting gear (certified) Inspection of gas storage area on weekly sheet Appropriate storage location Bollards Bottle trolleys to move cylinders Certified storage areas Audits/inspections (external /internal) Restricted Access		4						8.9 Hazardous Materials and Chemical Substances	4	E	10	Medium
WRR-0157	Site Wide	Onsite spill during delivery of reagents not contained on site	Vehicle collision - accident Tank failure Packaging failure Driver / delivery procedure error	Environmental damage Injury - chemical burns	3	D	9	Medium	Contractor management Contractor audits / inspections Certified Suppliers Designed fit for purpose transport storage vessels Ponds and Bunding MSDS on site MRT trained in chemical spill events CIMS training		3	3		3			8.9 Hazardous Materials and Chemical Substances	3	E	6	Medium

					Inherent Risk (Absent or failed controls/defences)						Impacted Areas (Maximum reasonable consequence)							Residual/Current Risk (controls present and applied)			
Risk #	**Department (Site wide available)**	**Risk Description** (What can happen)	**Potential Cause(s) (How / why might it happen?)**	**Principal Hazard Impacts**	**Consequence (Credible worst case)**	**Likelihood**	**Risk Level**		**Critical Controls**	**Current Controls**	**Health and Safety**	**Environmental**	**Social**	**Financial**	**Reputation**	**Compliance**	**OceanaGold Standard**	**Consequence (Maximum reasonable case)**	**Likelihood**	**Risk Level**	
WRR-0174	Site Wide	Oil / grease spills from heavy machinery / maintenance / contaminated ore causing environmental effect	Spills on floor of workshop (or underground) - runoff to truck wash, oil spillage during maintenance activities Mobile plant hydraulic hose failure. Refuelling spills. Component fatigue	Generally small spills that are contained on site but are frequent (30 per month). Cost of clean-up and disposal. Large oil slick in settling ponds (e.g. in Oct 08). Bund and interceptor management issues identified Oct 08. Potential decrease in mill recovery rates. Contaminated soil / water / waste / ore. Environmental impact	1	A	11	Medium	Hydrocarbon Management Plan, Emergency Plan, Spill kits. Inspection programme. Weekly maintenance checks and inspections. Little or no hydrocarbons in dewatering water, small spill register, large spill incidents. Awareness Training, audits Bunding around storage areas Spill response procedure Pre-start checks. Inspections and preventative maintenance programs Site runoff contingency ponds Upgrade of Favona refuelling & wash bay facilities. Mill refuelling pad bunding.		1						9.3 Used Hydrocarbons	1	B	7	Medium

15.6 CCCS

Critical Control Check Sheet						
PRINCIPAL HAZARD	Hazardous Substance	DATE				
CHAMPION	HSEC Manager	FREQUENCY	Six Monthly (minimum)			
Doc ID	WAI-250-CHK-008	FINDINGS				
CHECKLIST		G	A	R	COMMENTS	
Inspection / Observations – **Inspect all chemical storage locations –** • Signage in place, • SDS sheets in place, clear treatment plans identified • bunding adequate for spillages, areas are restricted if required • Separation distances between gas cylinders in storage locations						
Training and Competencies – • HSNO Approved handlers identified and in place • Approved fillers (Mines Rescue) **Machinery Operators** • Operators are trained and competent to identify hazardous substances issues / damage / potential emergencies • Trained and understand what to do if hazardous spill or incident / issues are identified						
Management Plan – • Principal Hazard Management Plan and working in accordance is in place and being followed **Emergency Plan –** • Check that emergency plan is in place and is understood for a serious spill or exposure, review high risk areas						
Appropriate support – • Sufficient support to keep chemaical up to date. Adequate transport and handling across site.						
Documentation – • Check documentation is - current test certificates, document stored in central locations, SDS sheets are up to date – good clear emergency actions on SDS						
Internal & External Incident Review						
Review HSEC Alerts internal and external incidents relevant to this PHMP						☐ Yes ☐ No
Review incidents relevant to the management of this Principal Hazard or controls						☐ Yes ☐ No

Document which one/s and what actions were taken		
Have Waihi incident reports been reviewed in the last period for reference to applicable PHMP events?		☐ Yes ☐ No
Were any reviewed Waihi incident reports relevant to the management of this Principal Hazard or controls?		☐ Yes ☐ No
If yes, which one/s, which ones and what actions were taken?		
Improvement Actions	**Assigned to**	**Due Date**
1.		
2.		
3.		
Comments:		

OVERALL RATING	
Green	• *No issues, a positive finding*
Amber	• *A condition that required action two levels or higher above normal operating level specified in the TARP (where applicable)* • *A technical failure occurred in the critical controls that was rectified immediately and did not increase the probability of a catastrophic event.*
Red	• *A failure occurred in a critical control which in turn increased the probability of a catastrophic event* • *A critical control was not reviewed during the reporting period. A continuation of Amber events over TWO or more quarters reverts to a red in the second quarter.*

SIGN OFF

I have checked the completed Critical Control Check Sheet and developed improvement actions for non-conformance.

GREEN ☐ AMBER ☐ RED ☐

Name:	Sign:	Date:
Principal Hazard Champion: HSEC Manager		
Site Senior Executive		

Attach any other documentation used during this inspection – This check sheet must be [illegible]

15.7 Certified (Approved) Handler Register – Intuition

Compliance	Expiry	Name	Workgroup	Employer	Compliance	Expiry
Certified Handler: Hazardous Substances - Reagents	5	BARDIN, Shaun (400003)	Waihi Processing Production Shift C	OceanaGold	11/11/2019	11/11/2024
Certified Handler: Hazardous Substances - Reagents	5	CRAWFORD, John (400014)	Waihi Processing Production Shift C	OceanaGold	25/07/2016	25/07/2021
Certified Handler: Hazardous Substances - Reagents	5	HONG, Seunghyung (400233)	Waihi Plant Metallurgist	OceanaGold	11/11/2019	11/11/2024
Certified Handler: Hazardous Substances - Reagents	5	LOWE, Peter (400053)	Waihi HST Advisors	OceanaGold	12/11/2019	12/11/2024
Certified Handler: Hazardous Substances - Reagents	5	MORTON, Scott (400066)	Waihi Processing Production Shift C	OceanaGold	11/11/2019	11/11/2024
Certified Handler: Hazardous Substances - Reagents	5	OLIVER, David (400069)	Waihi HST Advisors	OceanaGold	12/11/2019	12/11/2024
Certified Handler: Hazardous Substances - Reagents	5	PURCELL, Colin (400075)	Waihi Processing Production Shift C	OceanaGold	12/11/2019	12/11/2024
Certified Handler: Hazardous Substances - Reagents	5	SHARPE, Russell (400086)	Waihi Processing Production Shift C	OceanaGold	12/11/2019	12/11/2024
Certified Handler: Hazardous Substances - Reagents	5	SIMS, Brett (400087)	Waihi Processing Maintenance Supervisors	OceanaGold	12/11/2019	12/11/2024
Certified Handler: Hazardous Substances - Reagents	5	STEWARD, Caroline (400091)	Exploration Waihi Resource Geology Team	OceanaGold	25/07/2016	25/07/2021
Certified Handler: Hazardous Substances - Reagents	5	TWIDLE, Brett (400096)	Waihi Plant Metallurgist	OceanaGold	12/11/2019	12/11/2024
Certified Handler: Hazardous Substances - Reagents	5	EWING, Gary (400129)	Waihi Commercial Supply	OceanaGold	24/04/2017	24/04/2022
Certified Handler: Hazardous Substances - Reagents	5	HUIA, Fraser (400042)	Waihi Commercial Supply	OceanaGold	11/11/2019	11/11/2024
Certified Handler: Hazardous Substances - Reagents	5	MORGAN, Lewis (400065)	Waihi Commercial Supply	OceanaGold	12/11/2019	12/11/2024

15.8 Hazardous Substance Internal Training Register – Intuition

Compliance	Expiry	Name	Workgroup	Employer	Compliance	Expiry
Waihi Hazardous Substances	2	ANDERSON, Mark (400000)	Waihi Processing Production Shift C	OceanaGold	8/10/2020	8/10/2022
Waihi Hazardous Substances	2	BARDIN, Shaun (400003)	Waihi Processing Production Shift C	OceanaGold	6/10/2020	6/10/2022
Waihi Hazardous Substances	2	BATE, Kelly (400004)	Waihi Processing Production Shift C	OceanaGold	6/10/2020	6/10/2022
Waihi Hazardous Substances	2	BROAD, Denis (400271)	Waihi Processing Maintenance Mechanical	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	BURROUGHS, Mark (400008)	Waihi HSE Team	OceanaGold	10/11/2020	10/11/2022
Waihi Hazardous Substances	2	COX, Christo	Waihi Processing Maintenance Supervisors	Christo Cox Contracting	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	CRAWFORD, John (400014)	Waihi Processing Production Shift C	OceanaGold	8/10/2020	8/10/2022
Waihi Hazardous Substances	2	DAVIS, Tangaroa Amoa (400501)	Waihi Processing Maintenance Electrical	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	DAVISON, Scott (400507)	Waihi Processing Maintenance Supervisors	OceanaGold	5/11/2020	5/11/2022

Compliance	Expiry	Name	Workgroup	Employer	Compliance	Expiry
Waihi Hazardous Substances	2	HARGREAVES, Troy (400036)	Waihi Processing Production Shift C	OceanaGold	2/10/2020	2/10/2022
Waihi Hazardous Substances	2	HARLEY, Noel	Waihi Management Accountant	AWF	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	HILLYARD, Rebecca (400503)	Waihi Environmental Consenting Advisor	OceanaGold	10/11/2020	10/11/2022
Waihi Hazardous Substances	2	HONG, Seunghyung (400233)	Waihi Plant Metallurgist	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	KUIZINAS, Andrew (400050)	Waihi Processing Maintenance Supervisors	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	LOWE, Peter (400053)	Waihi HST Advisors	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	MCDONALD, Grant (400232)	Waihi Environmental Technicians	OceanaGold	10/11/2020	10/11/2022
Waihi Hazardous Substances	2	MORTON, Alex (400067)	Waihi Processing Production Shift C	OceanaGold	24/11/2020	24/11/2022
Waihi Hazardous Substances	2	MORTON, Scott (400066)	Waihi Processing Production Shift C	OceanaGold	8/10/2020	8/10/2022
Waihi Hazardous Substances	2	OLIVER, David (400069)	Waihi HST Advisors	OceanaGold	7/10/2020	7/10/2022
Waihi Hazardous Substances	2	PECK, Karl (400126)	Waihi Processing Production Shift C	OceanaGold	2/10/2020	2/10/2022
Waihi Hazardous Substances	2	PERKINSON, Shay (400108)	Waihi Environmental Technicians	OceanaGold	10/11/2020	10/11/2022
Waihi Hazardous Substances	2	PHILLIPS, Tegan (400304)	Waihi Processing Maintenance Electrical	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	RALPH, Anthony (400076)	Waihi Processing Maintenance Mechanical	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	ROSS, Brian (400081)	Waihi Processing Production Shift C	OceanaGold	8/10/2020	8/10/2022
Waihi Hazardous Substances	2	SMITH, Jason (400380)	Exploration Waihi Core & Field Technicians 1	OceanaGold	10/11/2020	10/11/2022
Waihi Hazardous Substances	2	SMITH, Maclean (400088)	Waihi Processing Production Shift C	OceanaGold	8/10/2020	8/10/2022
Waihi Hazardous Substances	2	SQUIRE, Russell (400089)	Waihi HSE Team	OceanaGold	10/11/2020	10/11/2022
Waihi Hazardous Substances	2	STOWELL, Greg	Waihi Processing Maintenance Supervisors	Stowell Engineering	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	TAWHITI, Jamie (400156)	Waihi Processing Maintenance Mechanical	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	UPEX, Stuart (400098)	Waihi Processing Maintenance Electrical	OceanaGold	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	WILLIAMS, Kirstie	Waihi Processing Maintenance Electrical	No 1 Electrical	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	WILSON, Darryl	Waihi Processing Maintenance Electrical	No 1 Electrical	5/11/2020	5/11/2022
Waihi Hazardous Substances	2	WILSON, Kevin (400106)	Waihi Processing Production Shift C	OceanaGold	6/10/2020	6/10/2022

15.9 Location Compliance Certificates

COMPLIANCE CERTIFICATE

Hazardous Substances Location

Issued to: **Oceana Gold Ltd**

NZBN [illegible]

Site Address: Mine Site, Baxter Road, Waihi 3610

Postal address:
PO Box 190
Waihi 3641

Phone: 07 863 9884

Certificate Number: 2102LCC196
Date of issue: 06/09/2021
Date comes into force: 06/09/2021
Date of expiry: 06/09/2022
Registration Number: CER-0301-[illegible]

This Certificate is issued in accordance with regulation 6.23 and regulations 10.34, 10.36, and 12.17 of the Health and Safety at Work (Hazardous Substances) Regulations 2017.

This certifies that the requirements prescribed in regulations 10.34, 10.36, and 12.17 have been met for the locations, substances, and maximum quantities specified below:

Class	Substance	Quantity and Location
3.1B / 3.1C	Flammable liquids	250L, in <20L containers, in Flammables DG Container external to Workshop
3.1B / 3.1C	Flammable liquids	250L, in <20L containers, in Flammables DG Container, in Stores
4.2C	Activated Carbon	20,000kg, in bags, in Yard, southeast of site
5.1.2A	Oxygen	30,000L, in bulk tank east of SAG Mill

This certificate is issued by the undersigned, being an individual compliance certifier authorised by WorkSafe New Zealand under regulation 6.8 of the Health and Safety at Work (Hazardous Substances) Regulations 2017, in accordance with regulation 6.8(2)(a) to (d) of those regulations.

Aaron Donald
Compliance Certifier
Registration # 301

HazSubs

235 Archers Road, Wairau Valley, Auckland 0627
Phone: +64 09 443 3054
Email: info@hazsubs.co.nz
Website: www.hazsubs.co.nz

COMPLIANCE CERTIFICATE

Hazardous Substances Location

Issued to: **Oceana Gold Ltd**

NZBN 9429036627110

Site Address: Mine Site, Baxter Road, Waihi 3610

Postal address:
PO Box 190
Waihi 3641

Phone: 07 863 9886

Certificate Number: 2002LCC384
Date of issue: 09/10/2020
Date comes into force: 09/10/2020
Date of expiry: 09/10/2021
Registration Number: CER-0301-053618

This Certificate is issued in accordance with regulation 6.23 and regulation 10.34 of the Health and Safety at Work (Hazardous Substances) Regulations 2017.

This certifies that the requirements prescribed in regulation 10.34 have been met for the locations, substances, and maximum quantities specified below:

Class	Substance	Quantity and Location
2.1.1A	LPG	1,000kg, in forklift cylinders, in yard
2.1.1A	LPG	40,000L, in bulk tanks

This certificate is issued by the undersigned, being an individual compliance certifier authorised by WorkSafe New Zealand under regulation 6.8 of the Health and Safety at Work (Hazardous Substances) Regulations 2017, in accordance with regulation 6.8(2)(a) to (d) of those regulations.

Aaron Donald
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Registration # 301

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Website: www.hazsubs.co.nz

COMPLIANCE CERTIFICATE

Hazardous Substances Location

Issued to: **Oceana Gold Ltd**

NZBN 9429036627110

Site Address: Mine Site, Baxter Road, Waihi 3610

Postal address:
PO Box 190
Waihi 3641

Phone: 07 863 9886

Certificate Number: 2002LCC529
Date of issue: 15/12/2020
Date comes into force: 15/12/2020
Date of expiry: 15/12/2023
Registration Number: CER-0301-058942

This Certificate is issued in accordance with regulation 6.23 and regulation 13.38 of the Health and Safety at Work (Hazardous Substances) Regulations 2017.

This certifies that the requirements prescribed in regulation 13.38 have been met for the locations, substances, and maximum quantities specified below:

Class	Substance	Quantity and Location
6.1A, 6.1C	Sodium Cyanide UN1689	60,000kg, in Aboveground tank, in Cyanide Mixing Area
6.1B, 6.1C	Sodium Cyanide Solution (30%) UN3414	100,000L, in Aboveground tank, in Cyanide Mixing Area

This certificate is issued by the undersigned, being an individual compliance certifier authorised by WorkSafe New Zealand under regulation 6.8 of the Health and Safety at Work (Hazardous Substances) Regulations 2017, in accordance with regulation 6.8(2)(a) to (d) of those regulations.

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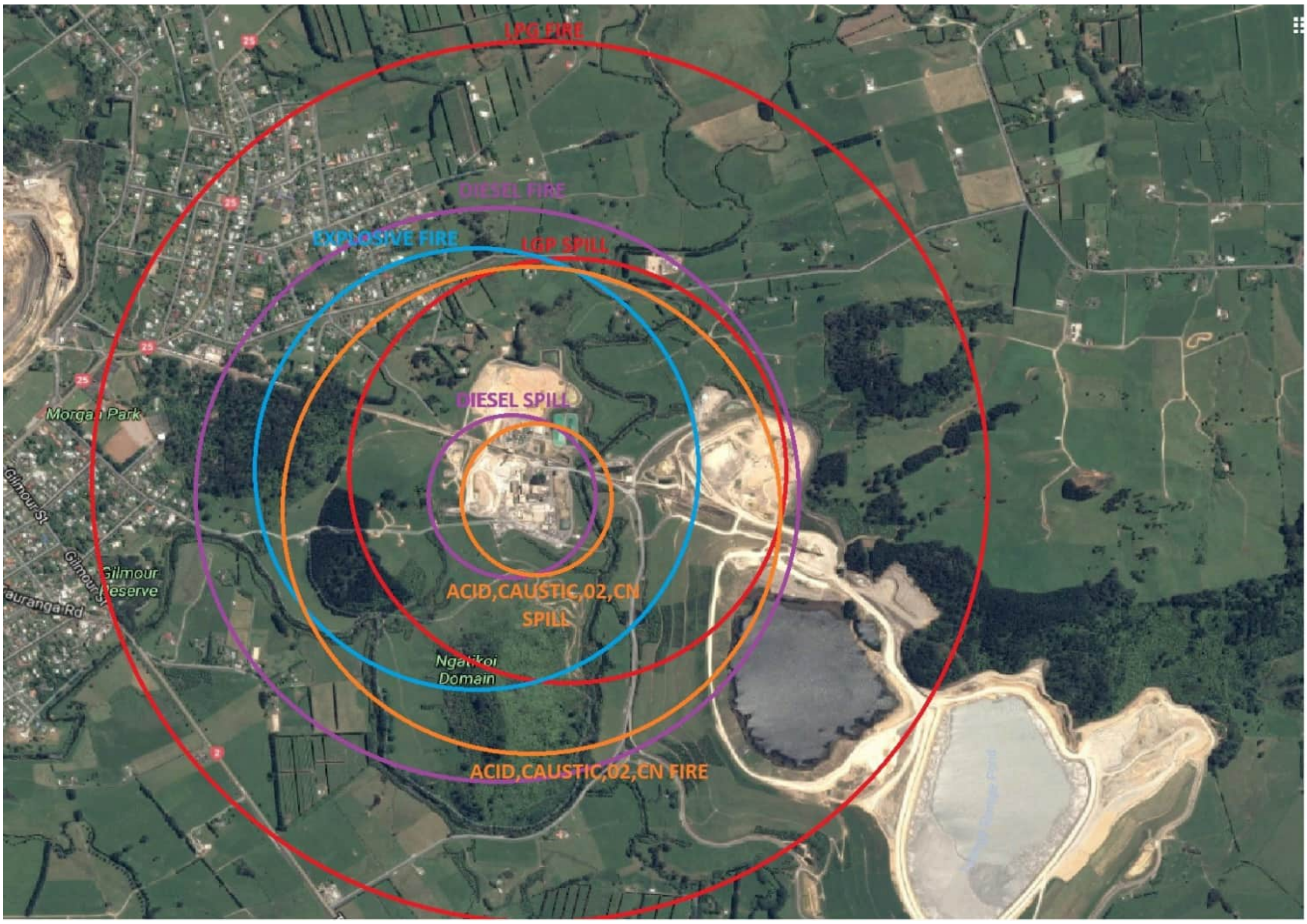
Website: www.hazsubs.co.nz

15.10 Public Safety Evacuation Zones



Evacuation zones are based on the Guides in the HB 76:2010.

- Explosives are based on the category and amount stored.
- LPG large spill 800m in all directions, fire 1500m in all directions.
- Diesel spill (large) 300m downwind or 1000m in all directions if on fire.
- Acid, caustic, O2 and CN are all downwind evacuations of 250m for a spill and 800m in all directions for fire.

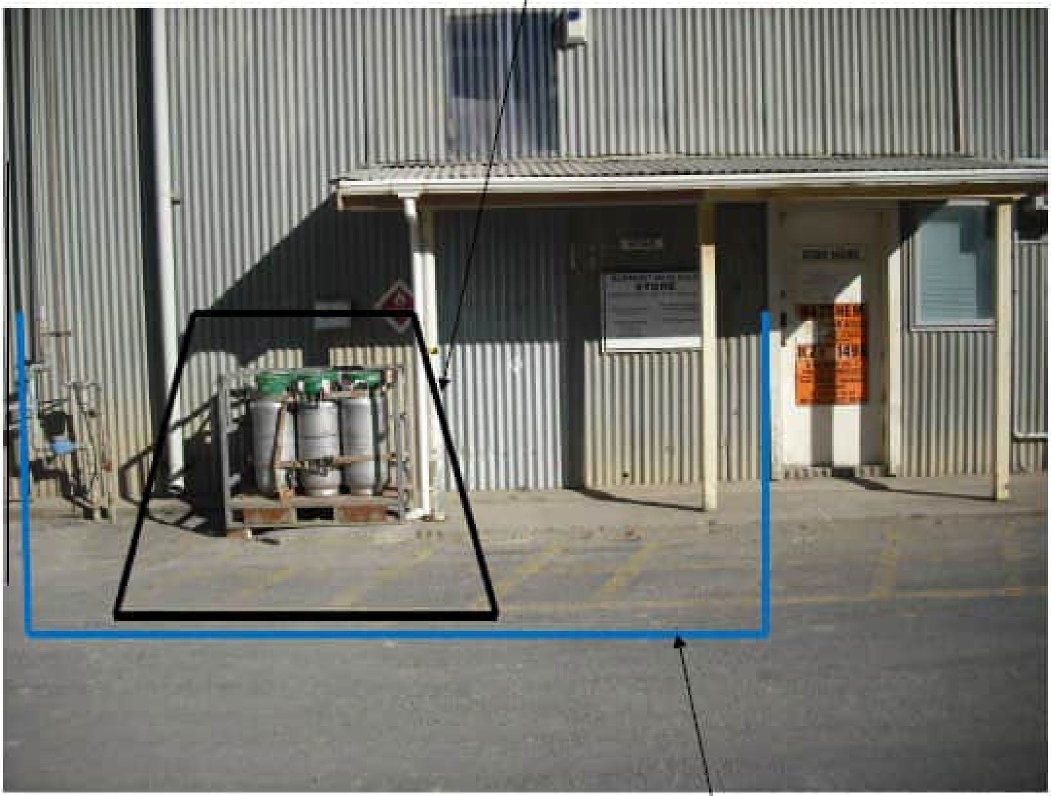
15.11 Forklift LPG Cylinder Location

Hazardous Atmosphere Zones for LPG Cylinder Storage

Extent: 1.5 meters at the base of cylinders

0.5 meters at top of cylinders

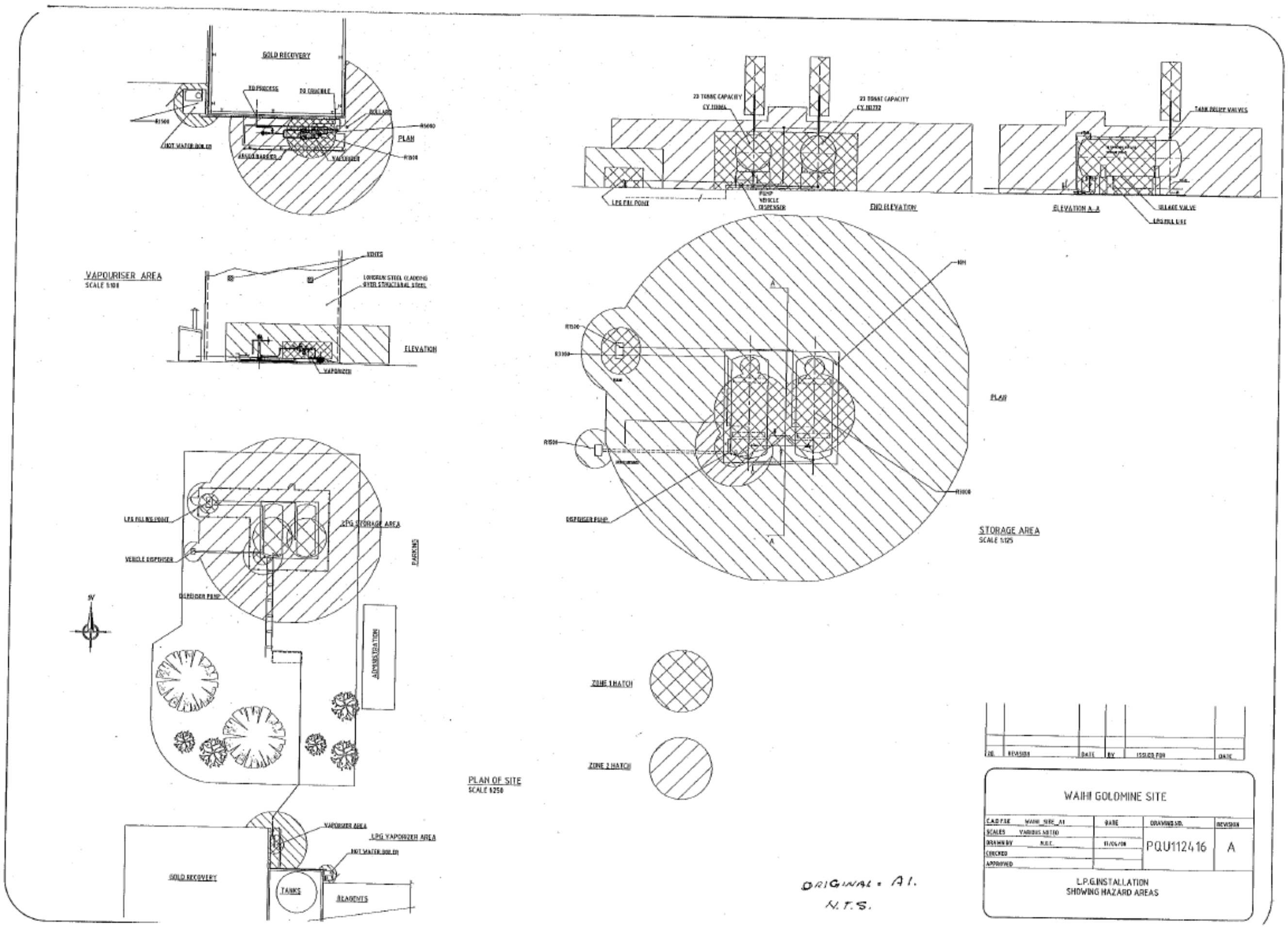
0.5 meters above cylinders



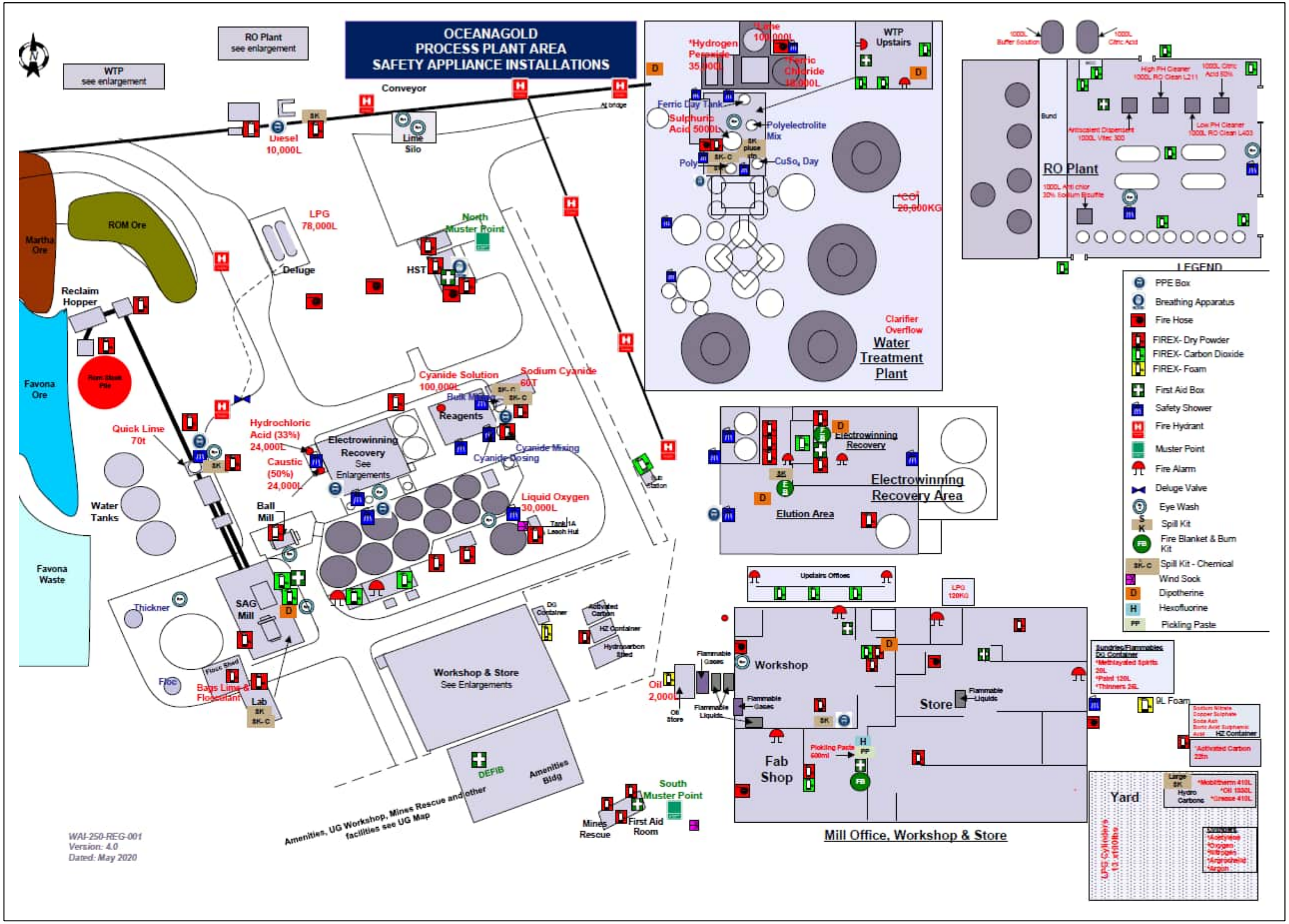
Controlled Zones

Extent: 3.0 meters to the left right and in front of the cylinders

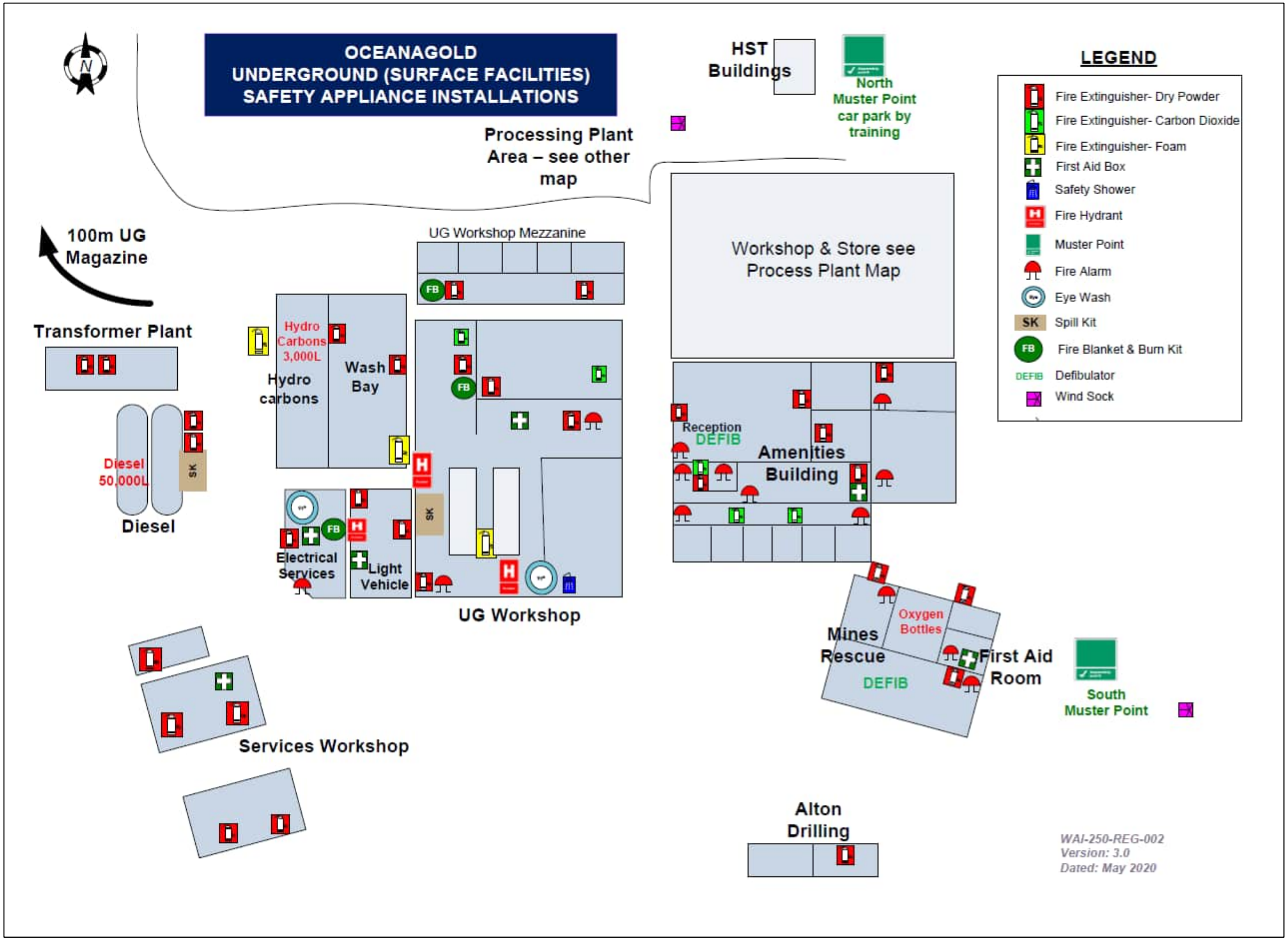
15.12 LPG Hazardous Atmosphere Zones



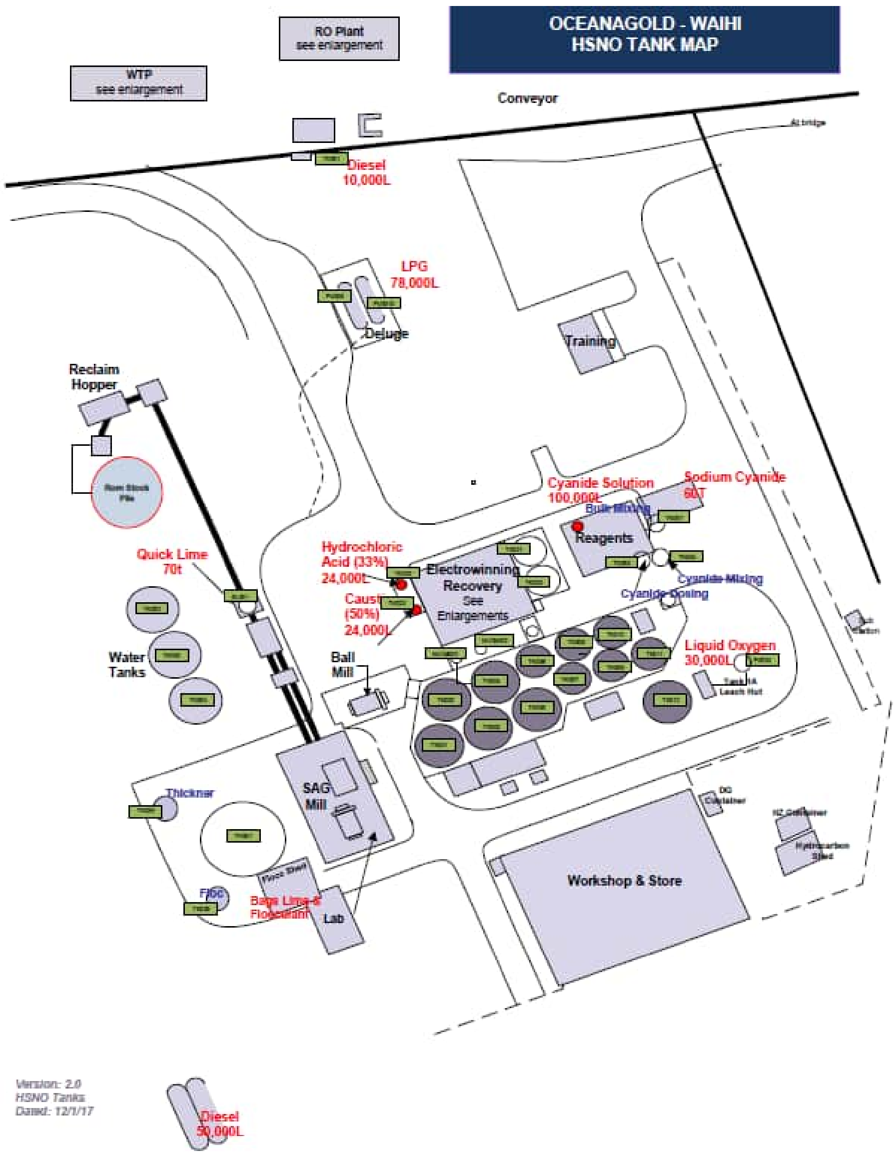
15.13 Process Plant Area Map

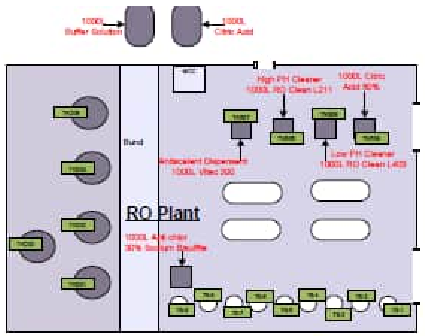


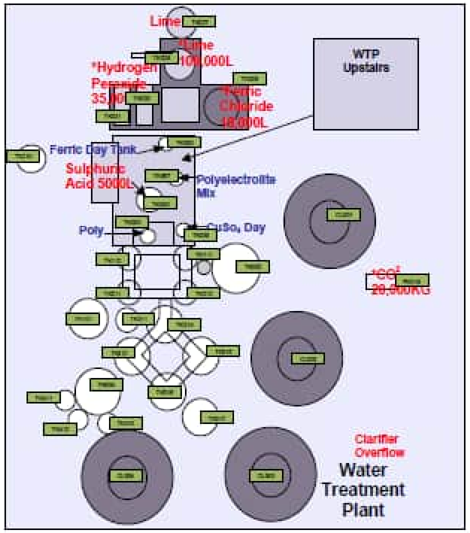
15.14 UG Area Map

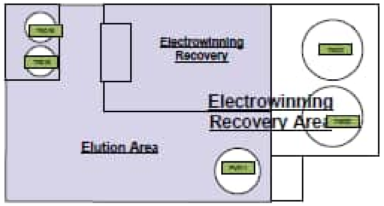


15.15 Tank Location









Tank Register – S Drive/Safety/Tank Register (snap shot)

Location	Site	Owners	Tank	Name	SAP No.	Alternative Tank #	Product Stored	Dens	Capacity (	Year Installe	Construction Type	Drawing	Placement	Standard	Pressure Manageme
Processing Plant	Leach & Adsorption	OG	TK005	Tank, Adsorption 5	2002-30-70-30-TAN0005	50-TNK05 WTK005 4188	Leach Tank Slurry	40% Solids	680,450	2006	Mild Steel	B1-9192-050-M-03	Above Ground	API 650	NA
Processing Plant	Leach & Adsorption	OG	TK006	Tank, Adsorption 6	2002-30-70-30-TAN0006	50-TNK06 WTK006 4189	Adsorption Tank Slurry	40% Solids	338,500	1987	Mild Steel	B1-9192-050-M-03	Above Ground	Spec 9192-M15	NA
Processing Plant	Leach & Adsorption	OG	TK007	Tank, Adsorption 7	2002-30-70-30-TAN0007	50-TNK07 WTK007 4190	Adsorption Tank Slurry	40% Solids	338,500	1987	Mild Steel	B1-9192-050-M-03	Above Ground	Spec 9192-M15	NA
Processing Plant	Leach & Adsorption	OG	TK008	Tank, Adsorption 8	2002-30-70-30-TAN0008	50-TNK08 WTK008 4191	Adsorption Tank Slurry	40% Solids	338,500	1987	Mild Steel	B1-9192-050-M-03	Above Ground	Spec 9192-M15	NA
Processing Plant	Leach & Adsorption	OG	TK009	Tank, Adsorption 9	2002-30-70-30-TAN0009	50-TNK09 WTK009 4192	Adsorption Tank Slurry	40% Solids	338,500	1987	Mild Steel	B1-9192-050-M-03	Above Ground	Spec 9192-M15	NA
Processing Plant	Leach & Adsorption	OG	TK010	Tank, Adsorption 10	2002-30-70-30-TAN0010	50-TNK10 WTK010 4193	Adsorption Tank Slurry	40% Solids	338,500	1987	Mild Steel	B1-9192-050-M-03	Above Ground	Spec 9192-M15	NA
Processing Plant	Leach & Adsorption	OG	TK011	Tank, Adsorption 11	2002-30-70-30-TAN0011	50-TNK11 WTK011 4194	Adsorption Tank Slurry	40% Solids	338,500	1987	Mild Steel	B1-9192-050-M-03	Above Ground	Spec 9192-M15	NA
Mill Area	Leach & Adsorption	OG	TK012	Leach Tank	2002-30-70-00-TAN0012	WTK012 60-TNK-03 4195	Leach Tank	40% Solids	675 000 L	1999	Mild Steel	856-50-M-006	Above Ground	Spec Drawing 856000-001	NA
Mill Area	Electrowinning Recovery, Elution	OG	TK018	Tank, Elution Makeup Pump	2002-30-70-40-TAN0018	WTK018 60-TNK-02 4197	Caustic Soda Cyanide Pre soak make-up	1	19,800	1987	Mild Steel		Above Ground	Spec 9192-M-15	NA
Mill Area	Elution - Water Storage	OG	TK019	Tank, Elution Water Storage	2002-30-70-40-TAN0019	WTK019 60-TNK-01 4198	River Elution Water	1	19,800	1987	Mild Steel	B1-9192-090-P-02	Above Ground	Spec 9192-M-15	NA
Mill Area	Gold Recovery	OG	TK020	Tank, Loaded Electrolyte	2002-30-70-40-TAN0020	60TNK03 4199	Electrolyte Storage Cyanide Slurry	1	202,500	1987	steel	B1-9192-060-M-05	Above Ground		AS 1554
Mill Area	Gold Recovery	OG	TK021	Tank, Spent Electrolyte	2002-30-70-40-TAN0021	60TNK04 WTK021 4200	Spent Electrolyte Cyanide Slurry	1	202,500	1987	steel	B1-9192-060-M-05	Above Ground		Spec 9192-M-15 AS 1554
Mill Area	Process Plant Area	OG	TK022	Hydrochloric Acid	2002-30-70-40-TAN0022	WTK022 60-TNK-06 4201	Hydrochloric Acid 33% (loaded electolyte)	1.18	29,550	2005	V66 Vinyl Ester Resin	E3188-04	Above Ground	Seismic Code NZS4203:1992	Continuously vented

Appendix E Principal Hazard Management Plan for Explosives

Principal Hazard Management Plan

Explosives

Approved date: April 2024

Document ID: WAI-400-PHM-007

Department	**Mining Operations**
Location/Site	Waihi

Approval table

	Position title	Name	Date
Authored by	Safety Training Systems Specialist	S. Haines	03/11/2022
Reviewed by	Trainer Learning & Development	C. Long	09/04/2024
Approved by	SSE / UG Mine Manager	D. Townsend	09/04/2024
Approved by	General Manager	J. Johns	17/04/2024

Document issuance and revision history

Document name: Explosives

Document id: WAI-400-PHM-007

Revision number	Revision date	Section	Page	Description	Effective Date
1.0				Review and Update to OGNZL	03/04/2016
2.0	Aug 2017	All		General review and update	08/08/2017
3.0	April 2019	All		Numerous updates	12/04/2019
4.0	April 2020	All		Add in reference to Procurement Guidelines, full document review	08/04/2020
5.0	May 2021	All		Approved by new SSE/GM	11/05/2021
6.0	Nov 2022	All		Approved by new SSE/GM	14/02/2023

6.1	06/03/2023			Updated to reference the Air Quality and Underground Ventilation PCP	06/03/2023
6.2	19/01/2024	3	5	Minor edit added Section 3 WAI-300-PLN-008 Health, Safety & Sustainability (External Affairs, Social Performance & Environment) Management System Overview	19/01/2024
7.0	09/04/2024	7.2	18	Changed wording 7.2 from " No welding to be done on the charge cage" to "No welding to be done on the charge pod and charge frame"	17/04/2024

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1 PURPOSE

To identify, analyse, and assess risk associated with the identified principal hazards of Explosives in operational areas. In addition, the Principal Hazard Management Plan for Explosives (PHMP-EXP) includes reference to government legislation, standard operating procedures, associated PHMP's, corporate standards and other measures to reduce risks to an acceptable level.

2 SCOPE

The PHMP-EXP is authorised by the SSE and applies to all workers in any capacity accessing the Waihi mining operation, and undertaking work associated with the identified principal hazard.

The plan will;

- Identify the principal hazards associated with Explosive use in our mining operations.
- Identify the risk management strategies associated with Explosive hazards.
- Establish hazard control, prevention, and monitoring mechanisms.
- Identify triggers for risk management actions when principal hazards occur, or are considered likely to occur, requiring urgent response in mining operations or urgent review of the plan.
- Provide a basis for document control and management of change to ensure that any future changes to mining processes or activities are recognised and evaluated, and that the PHMP is appropriately updated.

3 REFERENCE AND COMPLIANCE

OGL Waihi operations monitor compliance with legislation in association with external consultants. Regular audits are undertaken to monitor mine site performance in relation to specific legislation, codes of practices, guidelines, standards, and operating procedures. These include but are not limited to the following table:

Level	Source
Legislation or Guidelines	• Health and Safety at Work Act 2015
	• Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016
	• Hazardous Substance and New Organism Act 1996

Level	Source
	• Electrical (Safety)Regulations 2010
	• AS 2187.1 – 1998 – Explosives –Storage, Transport and Use Part 1 – Storage
	• AS 2187.2 – 1998 – Explosives – Storage, Transport and Use – Part 2 – Use of explosives
Corporate	• OGC-450-STD-005 Integrated Management System Standards
	• OGC-450-STD-020 Safety Performance Standards Manual
	• OGC-450-GUI-005 Risk Management Guidelines
Site	• Waihi Site Risk Register - SharePoint
	• WAI-420-MAN-002 Generic Explosives Underground Safety and Post Operational Resource Manual
	• WAI-420-MAN-005 Store, Handle and Transport Explosives
	• WAI-250-PHM-003 Hazardous Substances
	• WAI-400-PHM-007 Health, Safety & Sustainability (External Affairs, Social Performance & Environment) Management System Overview
	• WAI-400-PCP-004- Air Quality and Underground Ventilation
	• WAI-250-PCP Emergency Preparedness
	• WAI-402-PRO-002 Surface Magazine Operations
	• WAI-402-PRO-007 Management of Misfires in Headings
	• WAI-402-PRO-008 Waihi Density Sampling of Emulsion Phase

Level	Source
	• WAI-402-PRO-009 Underground Firing
	• WAI-402-PRO-003 Handle and Transport Explosives
	• WAI-401-PRO-002 Re-entry After Firing
	• WAI-420-PRO-001 Waihi Underground Tag Board
	• WAI-406-PRO-005 Protection of Electrical Cables during Firing
	• WAI-400-PRO-010 Continuity Testing of Underground Firing Lines
	• WAI-402-PRO-005 Development Charging
	• WAI-402-PRO-006 Production Charging
	• WAI-402-PRO-001 Disposing of Explosive Product
	• WAI-402-PRO-004 Disposing of Explosive Packaging
	• WAI-410-FOR-001 Charge Vehicle Possession Handover
	• WAI-420-PRO-011 Working Near Vertical Edges
	• WAI-420-PRO-010 Barricading, Signage and Demarcation
	• WAI-411-PRO-015 Underground Hot Work
	• WAI-470-FOR-009 Hot Work Permit

4 RISK ASSESSMENT

The site risk register is to be reviewed after all significant incidents. Formal Risk Assessments (FRA) are to be undertaken where changes to this document affect safety of personnel. Risk Assessments are to be conducted according to OGC-450-GUI-005 Risk Management Guidelines.

Other risk assessments that are associated with this PHMP-EXP have been referenced, where considered relevant, and recorded on OGL Waihi Site Risk Register - SharePoint.

A bow tie analysis was undertaken subsequently as a result of having identified Critical Risks in this WRAC. The summary of those risks and their critical controls are also listed below.

4.1 Risk Assessment Results Summary

4.1.1 Critical Risks (Unmitigated)

The following unmitigated Critical Risks were identified.

- Unauthorised Access to Explosive Products
- Unsecured explosives on transport vehicle
- Theft or Missing Explosives
- Unintended initiation of explosives during charging activities
- Incorrect priming, charging and firing practice causing premature uncontrolled detonation
- Failure to clear the blast area before blasting
- Drilling or Digging into a charged hole or misfire
- Explosives damaged and detonated from vehicle impact or collision or vehicle fire
- Faulty or incorrect blasting equipment or Explosive Products
- Hot Work carried out on or near where explosives are located
- Incorrect disposal of explosives
- Explosives or initiating system struck by lightning
- Excavating or crushing ore containing explosives including misfires (ROM pad & mill)

4.2 Critical Controls

A critical control is a control that will have the greatest impact on preventing the risk(s) relating to the principal hazard from occurring, or if the risk was to occur the critical control would provide the greatest mitigation of the potential consequences.

The following Critical Controls were identified:

- Vehicle designed/ built to standards to transport explosives, Fire Extinguishers on vehicles
- Purpose built carry boxes Surface and U/G
- Magazines storage licence
- All combustible material and flora removed form around magazine
- Locked magazines and fencing includes a locked gate
- Magazine key register (sign in/out) only for authorised personnel
- Keys to magazine compound locked and secured
- Weekly and monthly stock takes for Explosives in magazines
- Explosive products are labelled, stored, and separated according to classification
- Explosives products must be locked and secured when unattended
- Process for detection of missing or unaccounted for explosives
- Licensed and authorised shotfirers operate explosive vehicles

- Only Authorised Personnel Handle Explosives
- Only authorised persons associated with blast activities permitted in blast/charging area
- Explosive Products and Associated Blasting Equipment are Inherently Safe (use of Orica Blaster 3000 firing device and Electronic Detonators)
- Planned preventative maintenance is completed according to maintenance strategy
- Operators identify a fault during pre-start or in operation and equipment is taken out of service
- Testing of firing line prior to hook up U/G for electronic detonators
- Electrical protection systems operate correctly
- All controls identified in Hot Work Permit are to be in place and working
- Full clearance of effected areas U/G before firing
- Underground Tag Board and clearance
- Drilling plans to control stand off and drilling direction
- U/G keep a misfire record book
- Site rule drill no closer than 150mm from a butt U/G
- Removal of persons from area at risk
- Workers receive operator training for explosives awareness
- Appropriate PPE is available
- lightning TARP in procedure
- Initiation of emergency response

The risk treatment controls identified in the WRAC are addressed in this PHMP.

A process has been implemented to ensure controls systematically identified and deemed critical to maintaining the integrity of PHMP-EXP, are regularly conducted, thereby ensuring security and effectiveness of all measures. The Critical Control Check Sheet (CCCS) is the tool for regularly testing the effectiveness of internal procedures and controls. The CCCS will be utilised at a frequency as determined by the Waihi Senior Management Team and will be based on the completed reviews and analysis of the principal hazard.

4.2.1 Relation to Other Site Hazards

Explosives control is also related to the following principal hazard management plans at Waihi Operations.

- Electrical Engineering Principal Control Plan, deals with the management of electrical equipment utilised by the Waihi Operations
- Mechanical Engineering Principal Control Plan, deals with the management of pressure vessels and fixed plant
- Air Quality and Underground Ventilation Principal Control Plan, deals with Air Quality management in mining operations

- Explosives Principal Hazard Management Plan, deals with explosive use
- Hazardous Substance Principal Hazard Management Plan deals with hazardous substance management
- Emergency Response Risk Assessment and Principal Control Plan deals with emergencies involving Fire and Explosion

5 EXPLOSIVES USE

5.1 Transport to and from Charging Site

Explosives are to be transported to the area of use in accordance with site procedures which require:

- Only authorised, trained and competent people may handle explosives.
- Only approved vehicles can be used to transport explosives
- Explosives, detonators and blasting agents must be transported in separate approved containers

5.2 Production Charging

5.2.1 Authorised Charging Plans

Due to vibration control measures required at Waihi Underground Operations, production blasts must be in accordance with an Authorised Charging Plan (ACP) to ensure compliance with mining consents. Any significant alteration to this plan will require a separate ACP to be created. ACP details include:

- Location of blast
- Number of holes
- Charge and hole length
- Timing configuration
- Maximum charge weight per delay
- Maximum charge weight not to be exceeded
- Total initiation time

Charge plans are signed off by a Production Engineer and peer reviewed by another Mining Engineer or the Senior Engineer.

5.2.2 Charging Procedures

Before any work commences a workplace inspection and a Stop & Think must be conducted, all machinery must be pre-started, and any non-conformances must be reported to the Shift Supervisor immediately. If it any time there is excessive ground noise or fretting around a stope area, stop work, barricade the area and report it to the Shift Supervisor immediately.

Where a stope is to be charged from the lower level, a sufficient bund must be in place before work can commence in accordance with WAI-420-PRO-011 Working Near Vertical Edges.

5.2.3 Signs

The appropriate signs must be hung during charging activities and include “Danger - Charging in Progress”, “Danger - Open Stope Above/Below”, and “No Unauthorised Entry”. When charging is complete a “Danger – Charged Face” must be hung across the drive. No one can proceed past this sign without permission from the Shotfirer or Shift Supervisor.

5.3 Firing

5.3.1 Initiating Blasts

Any explosive can only be fired by the Charge-Up Operator with the approval of the Shift Supervisor. The Charge-Up Operator is responsible for correct and complete performance of site procedures, including but not limited to:

- Clearing the heading prior to firing
- Placement of appropriate signage
- Correct hook up processes
- Requesting the Shift Supervisor to clear the tag board
- Requesting permission to fire from the Shift Supervisor
- Initiating the blast notification device
- Initiating the blast, checking the firing lines and restarting the ventilation fan (if appropriate)
- Communicating all firing information to their Shift Supervisor

5.3.2 Designated Firing Positions

Generally, all firing will take place at the Designated Firing Point (DFP) at the underground crib room or surface tag board, However, if another location is to be used it must be approved by the Underground Mining Manager and be subject to a risk assessment. The new location must:

- Be in a fresh air intake which will not be exposed to any fumes from the blast
- Have appropriate ground support including mesh and/or shotcrete
- Be at least 300 metres away or around two corners from the blast
- Be at least 20 metres away from any vent doors, brattices or suspended vent fans
- Be checked for intersections with diamond drill holes and have any such hole grouted if it has the potential to intersect the orebody or any development.
- Where applicable, be in an area with good radio or telephone communication to the surface

5.3.3 Firing Cable

Firing cable is to be maintained from the DFP to within 100 metres of the face. All joins in the firing cable must be done correctly to prevent short circuits. Firing cable should be tested regularly by the Charge-Up Operator and/or mine electricians as part of their firing procedures. Any defects must be reported immediately to the Shift Supervisors and rectified before firing can take place. All ends must remain ‘open’ and checked before commencing any work on a firing cable. To avoid electric currents being induced in any firing line and creating unplanned initiation they must never be installed parallel to and within 300mm of any power or communications cables. If a firing line needs to cross these services, it must do so at right angles. Insulation resistance testers should never be used on firing lines.

5.3.4 Firing Procedure

Immediately prior to firing, the face/s and/or stope/s are hooked up in the following order:

- Walk around the shot and ensure all detonators are connected to the harness wire by counting clips against number of detonators used
- i-kon™ Starter Dets can be ‘hooked-up’ when charging in area has been completed
- Log detonators (via Logger) as per blast plan
- Connect harness wire and detonators to firing line once complete
- Connect logger to firing line at the designated remote firing location and test dets.

Once this process is complete, the shot crew/s retreat to the DFP having ensured the correct signage is hung at the required locations. Clearance to fire is obtained from the Shift Supervisor and the shots may then be fired with an approved initiation device. When firing is complete this must be communicated to the Shift Supervisor.

5.3.4.1 Maintenance / Safety Blasts

Maintenance /Safety blasts can be conducted 24/7 365 days a year.
A ‘Maintenance / Safety Blast’ is defined as: ‘Blasts for maintenance / safety purposes includes breaking over-sized rocks, trimming / slashing of backs, walls and floors, firing of mis-fired explosives and removal of bridged stopes.’ A maximum of 20Kg of explosives may be used and the blast must not exceed 2 seconds duration and 1mm/s vibration.

5.4 Re-Entry After Firing

Blast Fumes Carbon monoxide (CO) is one of the most hazardous by-product gases of blasting. CO is a colourless, odourless and tasteless gas; it is lighter than air and is extremely toxic even in low concentrations. CO will always be present if smoke is visible therefore gas testing of fume clearance times is required for safe re-entry. Nitrous oxide is colourless with a slight smell and nitrogen dioxide is reddish brown and has a distinctive smell. It is heavier than air and is extremely toxic even in low concentrations. Other possible fumes are SO2, CO2 and NH3.

5.4.1 Re-Entry Procedure

A minimum of 30 minutes must elapse from the time of firing before entering the fired level to conduct a re-entry inspection. No one may enter a blast area until it has been cleared by the re-entry crew or another delegated competent person. To clear a heading the re-entry crew must:

- Gain consent from the Shift Supervisor to re-enter fired headings
- Use a calibrated gas detector to check area is clear of blast fumes. If fumes are still present at unsafe levels the re-entry crew must retreat to fresh air and wait before testing again
- Roll up used bell wire and adjust signage to reflect change in heading status
- Check for misfires or any other hazards and notify the Shift Supervisor immediately if identified
- Notify the Shift Supervisor when level has been cleared and it is safe to resume work

Re-entry into an area following a maintenance / safety blast can occur 5 minutes after the firing as long as all other normal re-entry procedures are followed.

5.4.2 Testing Blast Fume Clearance Times

The Ventilation Engineer will be required to undertake periodic gas testing to establish safe re-entry times as mining areas progress. All measurements taken must be accurately recorded in the ventilation logbook and all entries dated and signed as per logbook standards. All measurements recorded are to be reported to the Underground Mining Manager.

Reference:

WAI-401-PRO-002 Re-entry After Firing

5.5 Other Explosives Use

There shall be specific JHA's developed for all other uses of explosives not covered in site procedures.

The JHA will give consideration to the following:

- The storage and transport of explosives
- Training and competency requirements
- Specific explosive types
- Guarding/barricade requirements
- Environmental effects (vibration, noise etc.)
- Infrastructure location and public access
- Firing instructions
- Emergency instructions including misfires

5.6 Atmospheric Electrical Activity

During an electrical storm there shall be no activity involving explosives conducted on the surface.

The magazine shall be evacuated and secured and not re-entered until 30 minutes after the last occurrence of thunder. The earthing connections on all magazine facilities shall be checked for electrical continuity at least every twelve months. There shall be no wiring in electric detonators while an electrical storm is in the vicinity.

5.7 Misfires

A misfire is defined as:

- Any hole or portion of a hole that has a signal tube, detonating chord or remnant explosives visible
- Any hole, cut off, butt or remaining portion of a hole that is suspected to contain explosives
- Any hole that has not been washed out or cannot be checked for any reason

The Underground Shift Supervisor must be notified of any misfires immediately and all details recorded in the Misfire Logbook. If the misfire cannot be rectified during that shift, then the Shift Supervisor is to note the misfire location on the muster white board for the oncoming shift. Each heading and stope is inspected for misfires on re-entry as per site re-entry procedures. An electrically initiated complete misfire cannot be approached for at least five minutes. Misfires must be dealt with as per procedure and only by authorised personnel. The Underground Mining Manager must be notified immediately if any complete round misfires for an unknown reason or if there is any unplanned initiation of any explosive.

6 EXPLOSIVES DELIVERY AND STORAGE

6.1 Explosives Used on Site

All explosive products used at Waihi Underground must have an approved SDS from the supplier which is readily accessible to all personnel working with explosives. Explosives used at OGNZL include bulk explosives (Ammonium Nitrate Fuel Oil (ANFO) and emulsion), packaged explosives and electronic, electric and non-electric detonators. Explosive precursors, emulsion phase and gasser, are stored in the magazine facility though they are not classified as an explosive product until mixed (prior to mixing they are hazardous substances). Mixing of the products does not occur until immediately prior to charging therefore they are not stored, handled or transported as explosives. If any new products are introduced to site, they are subject to the same risk assessment, testing and management strategies as the explosives currently in use.

6.2 Delivery and Receipting of Explosives

Explosives are delivered to site by an approved dangerous goods transport provider. All explosives transport vehicles must comply with the relevant site standards and all operators must be inducted to drive unaccompanied to the underground office block or be accompanied by a site escort.

When explosives are delivered, they must be placed in the surface magazines in accordance with site procedures. This necessitates an Authorised Person to be present whilst unloading explosives. The Authorised Person must:

- Check off all explosives against the delivery docket as they are unloaded into the appropriate magazines
- Sign the delivered explosives in to the magazine logbook
- Sign the delivery docket to verify the explosives received match those listed on the docket, any discrepancies will be reported to the Production Engineer immediately.
- Lock the magazines
- Give the signed delivery docket to a Production Engineer to process as received through stores

6.3 Access, Security and Capacity of Magazines

The magazines at Waihi Underground operation are located on the surface. Access to the magazine is restricted to approved underground and explosives supplier personnel only. The keys to the facility are kept with the Shift Supervisor and Production Engineers and a register is kept of the keys being signed in and out. A point-to-point laser system is armed and monitored by security personnel. The access road and magazine facilities have appropriate signage as stipulated in the relevant site procedure. Dry chemical powder extinguishers are provided in the magazine yard with accompanying signage. All magazines must have relevant location test certificates issued by a test certifier. Due to the proximity of the mill, stores and residential housing the magazines have capacity limits. These certificates are displayed in the magazines, and it is the responsibility of the Production Engineer that these limits are not exceeded.

6.4 Magazine Rules

The explosive magazine has a location test certificate which implies consent with all relevant standards and regulations.

The magazine rules are as follows:

- Magazines are to be kept locked, only authorised persons may unlock the magazines
- A person must not smoke,vape or bring any other items likely to cause fire or explosion, within 15 metres of any magazine
- Mobile phones, pagers, handheld two-way radios or other electronic transmitting equipment must not be taken into a magazine
- A person is not to enter the magazine, be in the vicinity of a magazine or handle explosives if under the influence of drugs or intoxicating liquor
- No persons under 18 years of age are permitted to enter a magazine

- A person shall not wear footwear, which has an outer covering consisting wholly or partly of iron or steel
- All explosives movements in and out of the magazines are to be recorded in the explosives logbook and all explosives are stored according to all statutory regulations and site procedures
- Blasting agents, explosives and detonators are to be segregated appropriately
- Explosives shall be used in the order of the date of manufacture, the oldest explosives being used first (opened or damaged boxes of explosives should be used before any other boxes)
- All box stacks are not to exceed two metres in height. Where there is a risk of the packaging being damaged by compression, the explosive should be stacked accordingly
- The gap between the magazine wall and packaged explosives shall be no less than 50mm, to allow adequate ventilation between the wall and boxes
- No “HOT WORK” (i.e., grinding, welding etc.) will be performed in or near a magazine without the approval of the Underground Mining Manager
- Prior to disposal of any packaging, it shall be inspected for any remaining explosives, split and flattened, the surroundings of a magazine are to be kept free from dry grass or other combustible or flammable materials to a distance of 10 metres, standing timber is to be cleared for a distance of 30 metres and vegetation to 15 metres
- Housekeeping should be of a standard that ensures good access/egress, clear access to all fire extinguishers and elimination of any trip hazards
- If an explosive spills or leaks, the approved handler must ensure the spillage is removed and disposed of immediately
- The Certified Handler must ensure that when a motor vehicle is in the vicinity of a magazine and the engine of the vehicle is running, the door of the magazine is closed
- Any person handling cases or packages containing explosives must ensure that the cases or packages are not opened or closed in a magazine unless they can be opened without using tools of any kind
- If tools are used to open or close any package or case containing explosive, the tools are not made of ferrous material or any other material that could generate a spark
- The Certified Handler must ensure that all explosives in a magazine are marked in accordance with the New Zealand regulations
- Any damaged or otherwise defective or unsatisfactory packages containing explosives are not stored in a magazine and that any explosives contained in such a package are immediately repacked in a sound and satisfactory package
- The magazine shall be evacuated and secured during an electrical storm and not re-entered until 30 minutes after the last occurrence of thunder.

6.4.1 Damaged or Deteriorated Explosives

Any explosives that are damaged, out of date, leaking, exuding or otherwise defective or deteriorated, are destroyed and disposed of in a manner as described in site procedures for Disposing of Explosive Product. Bins are provided in the magazines for defective explosives as identified above. Segregation rules apply as per normal explosives and detonators. Where safe and practical, unsafe packaged explosives and detonators are to be disposed of in the next appropriate blast. ANFO is to be disposed of by dissolving with water; this is to be done under direct supervision of an authorised person. Where the quantity of explosives to be disposed of is excessive (>10 kilograms packaged product), they are to be stored and returned to the supplier for disposal.

Reference:

WAI-402-PRO-001 Disposing of Explosive Product

WAI-402-PRO-004 Disposing of Explosive Packaging

6.5 Inspections and Stocktake

A full stock take of the surface magazine must be undertaken every shift by the authorised Charge-Up Operator. An additional stock take is undertaken twice a week by either the Underground Storeman or Production Engineer. Any explosive product removed or returned to the magazine must be booked in or out in the logbook. If there is a discrepancy found during the stocktake that cannot be immediately resolved, the Shift Supervisor must be informed before the stocktake person leaves the magazine. If the discrepancy cannot be resolved before the end of shift, then an incident must be raised, and the Underground Mining Manager notified. Monthly management inspections are completed on the magazine facility and compound area and a signed checklist is filled out and kept on record. The Underground Mining Manager is responsible for ensuring all corrective actions are followed up and completed on time.

7 CHARGING EQUIPMENT AND MAINTENANCE

7.1 Charging Equipment

7.1.1 Transport

Explosives will be transported underground either in the charge cage (secured ANFO only), or in the back of an approved light vehicle. Any vehicle transporting explosives must be equipped with a flashing blue light, explosives signs, earth chain and a fire suppression system.

7.1.2 Charging

If ANFO is being used an IT and charge cage is utilised. The charge cage has certified kettles, is equipped with lo-stat ANFO hoses and has an earthing strap.

A mobile charging unit (Charmec) fitted with a Hypercharge unit will be used if charging with emulsion. A smaller portable Hypercharge unit that attaches to an IT may also be used for charging with emulsion. All units are equipped with a fixed fire suppression system.

7.1.3 Firing

The i-kon™ Blaster 3000 device is used to initiate all blasts on the main firing line. The Blaster provides the voltage and command to fire i-kon™ detonators in programmed sequence.

7.2 Maintenance

Prior to any explosives equipment undergoing maintenance the following considerations need to be considered:

- Remove all explosives and wash down machine before servicing
- Charge Vehicle Possession Handover form completed
- Use hot work permits where relevant and earthing during welding
- No welding to be done on the charge pod and charge pod frame
- No one is permitted to work directly on the pump of the Hypercharge Drive system. If a problem with the pump occurs, notify the Production Engineer who will arrange for Orica to service it.

7.2.1 Inspection and Testing

The following inspections and tests are carried out as part of a weekly service:

- The condition and structural integrity of the charge cage is inspected
- The resistance of the earthing strap on the ANFO charge cage is tested and recorded
- The relief pressure on the safety valves on the kettles is tested in conjunction with testing of the regulators
- Any information on faults or repairs noted on the daily pre-start checklist should be tended to as well (if not fixed previously)

7.2.2 Preventative Maintenance

All equipment used underground is subject to a preventative maintenance program. All equipment is brought to the surface workshop on a routine basis so appropriate checks, inspections and tests can be carried out. In addition to this, ANFO kettles will be pressure tested annually by a registered organisation.

Reference:

WAI-410-FOR-001 Charge Vehicle Possession Handover

WAI-470-FOR-009 Hot Work Permit

8 COMPLIANCE CERTIFICATES REGISTERS

All explosives and precursors storage areas are required to be annually certified by a Compliance Certifier. These compliance certificates are to be kept at the magazine or chemical storage locations, as well as in Registers in INX InControl.

9 TRAINING AND COMPETENCIES

All authorised appointed persons and all other workers involved in handling, transport, charging or firing explosives will be trained and assessed in site competency assessments and any other relevant site documentation. Training records will be maintained and kept on site and can be viewed upon request. Certified Handlers must have the appropriate certificates, a copy of which is kept on their training file.

Only people who hold a Certified Handlers Certificate (for the purposes of the HSNO Act 1996) and relevant site training assessments may handle explosives.

All persons under training must be supervised by an authorised person until such time that they attain the required certificate/licence for their task/role.

Only people who have been trained and assessed in site competency assessments, authorised by the UG Mine Manager and hold a valid Controlled Substance Licence (CSL) may have unsupervised access to explosives.

Department managers must ensure that all relevant mine workers receive explosives awareness during area specific induction training, refresher induction training, and through ongoing job safety training as per the sites training processes.

10 FITNESS FOR WORK

OceanaGold has a strong commitment to ensuring that all workers present fit for work. This includes not being adversely affected by the effects of medication, illegal drugs, alcohol, stress, injury or illness and dehydration. Fitness for Work testing programs are in place at the Waihi Operations.

Reference:

WAI-250-PCP-002 – Principal Control Plan Waihi Worker Health

11 EMERGENCY RESPONSE

In the event of an emergency, the site Emergency Response Team (ERT) shall be activated according to site procedures. ERT shall manage the initial emergency in accordance with the Emergency Management Control Plan and specific Trigger Action Response Plan (TARP).

Reference:

WAI-250-PCP-001 Emergency Management Principal Control Plan

12 SUPERVISION, MONITORING AND REVIEW

Supervisors are critical in ensuring workers remain safe while undertaking work. They ensure that the systems, processes, and procedures associated with tasks are being followed by review, inspection and undertaking behavioural based observations of all work activities under their control, ensuring workers have the appropriate competencies and resources to undertake the work task.

Contractor management is achieved through the allocation of a principal representative who is responsible for ensuring all site and task specific requirements are met and communicated to the contractor.

12.1.1 Contract Management

All support items at Waihi are purchased via Contract, the contract is put in place with minimum obligations and requirements, e.g., OGN 2888, i.e., the contract for the supply of Ground Support elements, Sections 13.3 – 13.5. outlines expected Quality Management and Qualitative non-performance and how these issues are to be managed with OGLNZ and the designated Supplier.

Reference:

WAI-300-PLN-008 Health, Safety, Environment, and Community (HSEC) Integrated Management System Overview

WAI-300-PLN-017 Contractor Management

13 RESPONSIBILITIES AND ACCOUNTABILITIES

Roles	Responsibility
SSE	• Must hold the relevant competency requirements as outlined in the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016 • The Senior Site Executive is responsible for workforce participation and consultation in the development of this PHMP, that the plan is reviewed and audited in accordance with this PHMP and that it is communicated and made available to all employees
UG Mine Manager	• Must hold the relevant competency requirements as outlined in the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016 • Ensure operational compliance with this plan • Authorising appointed persons to work with Explosives • Notifiable events are investigated, recorded and reported
UG Mine Superintendent	• Collating all of the documentation relating to blasting activities i.e., face sheets and blast number recording • Authorising appointed persons to work with Explosives • All necessary documentation is being completed and filed appropriately • All inspections and stock takes are completed and in accordance with this PHMP • Any discrepancies are reported to the Underground Mining Manager as per the site procedures • Compliance and maintenance of standards of all magazine rules

Supervisor	• Supervising handling, transport, charging, firing and re-entry operations and ensuring compliance with procedures and approved charging plans • Blasting and firing documentation is completed • Blast clearance and re-entry processes undertaken prior to re-entering the mine • Giving clearance to the Designated Shotfirer for blasting • Manage the firing of misfires during normal blasting hours • Giving re-entry clearance for headings after re-entry procedures have been completed by competent persons • Ensure all persons who handle, transport, charge or fire are trained, assessed, ticketed and, if required, appointed to do so • Ensure completion of misfire book as required • Communicate all charging and firing information to the oncoming Shift Supervisor • Accounting of explosives documentation is carried out and correct • Inspections of explosives areas and the use of explosives
Engineers (Production / Drill and Blast)	• Drill & Blast design and issue of approved plans • Ensure drilling, charging and firing operations are conducted in accordance with approved plans • Compliance with all magazine rules • Manage magazine location and design certification • Ensure magazine stock takes are completed in accordance with site procedures • Explosives stock control

Maintenance Superintendent	• The explosive equipment maintenance schedule is adhered to • All tests and inspections are carried out as per standard operating procedures
Charge-Up Operator	The Charge-Up Operator is responsible for the correct and complete performance of all firing operations. This includes but is not limited to: • Following the firing procedure and communicating all firing information to their Underground Shift • Ensuring the locking of the magazines and explosive boxes on the explosive LV's always when they are unattended and safekeeping of the keys • Conduct handling, transport, and charging operations in compliance with procedures and approved charging plans • Ensure safe disposal of defective explosives • Maintaining the stock rotation system • Complete all required documentation including the Misfire Book • Ensuring housekeeping of the magazines is to standard, ensuring all explosives movements in and out of the magazine are documented in the appropriate magazine log • Conduct daily stocktake of magazine or as required • Any discrepancies are reported to the Shift Supervisor as per the site procedures
Mine Worker(s)	All employees are required to ensure compliance with all procedures in relation to explosives. They must not handle, transport, charge or fire explosives unless they have been trained, assessed, ticketed, and authorised to do so, or under direct supervision of an authorised person.

14 RECORDS AND DOCUMENTATION

OceanaGold uses the on-line safety management system and software INX to record and store safety, health, hygiene, and training requirements. Records are stored securely and indefinitely within this facility. The following suites are specific to the type of data stored and managed:

- InControl – Event and incident reporting, action tracking, audits, inspections, task observations, Mine Record Entries and Management of Change
- InTuition – Worker's training and competency requirements
- InHealth – Worker health monitoring and occupational hygiene monitoring programs.

All inspection and maintenance records are to be held by the relevant department or through Corporate maintenance databases i.e., Pronto.

This document is a controlled document secured within the OceanaGold document control system Team Binder and published to the site through SharePoint.

Any changes made to this document must be documented in the revision reference.

15 AUDIT AND REVIEW

This plan shall be reviewed every 2 years as a minimum and/or in any of the following circumstances:

- Following any event or investigation that impacts on this plan
- Any amendments to the site risk register
- Any amendments to legislation

The SSE must organize for an external audit to be conducted at least once every three years from the date this document is approved by the SSE. The external audit should be carried out by a competent person who is independent of the mining operation. Details of the above audits should be retained for twelve months from the date at which the mining operation is abandoned.

Reference

WAI-300-PLN-011 Internal and External Audits

16 DEFINITIONS

Term	Definition
ANFO	An approved mixture of ammonium nitrate and fuel oil (diesel)
Blasting Operations	Include: • Priming a cartridge; • Charging and stemming a hole; • Connecting the detonator into a round of shots; • Coupling a shot firing cable or lead-in line into a detonator circuit, circuit tester or exploder; • Testing a shot firing circuit; or Firing a shot or round of shots
Bowtie	Form of risk assessment for Principal Hazards
Burden	The distance between a blast hole and a free face, or the distance holes in a blast pattern.
Certified Handler	A person who has met the competency requirements of the Health and Safety at Work (Hazardous Substances) Regulations 2017 and has been certified by a Compliance Certifier for explosives. (previously termed "approved handler" under the HSNO Act).
Critical Controls	A single control or control type (group, category) that significantly reduces the likelihood or consequence of a Principal Hazard and/or addresses multiple causes or mitigates multiple consequences of the Principal Hazard.
Danger Zone	An area in which a person may be injured, or machinery may sustain damage as a result of shot firing activities.
Detonator	A detonator is a device used to trigger an explosive device. Detonators can be chemically, mechanically, or electrically initiated, the latter, two being the most common
Exploder	Any electrical apparatus approved for the purpose of initiating detonators in a mine
Explosives	Includes detonation cord, detonators, relays, signal tubes, signal tube starters, primed cartridge or similar devices

Term	Definition
FRA	Formal Risk Assessment: WRAC or Bowtie
Magazine	An approved store, which is exclusively used for the storage of explosives
Misfire	An occurrence where: • Testing before firing a shot reveals broken continuity which cannot be rectified; or • Any shot, or whole or part of a round, fails to explode when an attempt is made to fire it.
PCP – Principal Control Plan	A document that outlines: • The systems and processes in place at the mining operation to manage hazards at the operation; and The measures that are necessary to manage principal hazards at the mining operation
PHMP – Principal Hazard Management Plan	A document that: • Identifies the nature of all principal hazards at any mining operation: and Sets out the measures that will be used to ensure that all principal hazards are effectively managed
Risk	The chance of something happening that will have an impact upon objectives. Risk is measured in terms of a combination of the consequences of an event and their likelihood
Risk Management	The processes and structures that are directed towards identifying and managing risk
Shot	A charge of explosive (in a cartridge) placed in a shot hole in coal or other rock (or stone) for the purpose of breaking the coal or rock (or Stone).
Shotfirer	A person appointed by Mine Management to conduct shot firing who holds a Certified Handler (or HSNO approved handler certificate) for "use" of explosives with no limitations.
SSE	Site Senior Executive
SharePoint	OceanaGold SharePoint Intranet
Stemming Material	Inert coarse material, such as crushed gravel about 1/10th hole diameter, loaded into the blast hole to confine

Term	Definition
	the gaseous energy and prevent it from venting into the atmosphere
TARP	Trigger Action Response Plan
Team Binder	OceanaGold document control system
WRAC	Work Risk Assessment and Controls

17 APPENDIX

17.1 Legislation Compliance Checklist

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
Regulation 86: Principal hazard management plan for explosives The PHMP for explosives must, at a minimum, address the following matters:	
(a) transportation of explosives at the mining operation:	Section: 5 Explosive Use; 5.1. Transport to and from Charging Site WAI-402-PRO-003 Handle and Transport Explosives
(b) explosive precursors:	Section: 5 Explosive Use; Section: 6 Explosive Delivery and Storage Section: 7 Charging Equipment and Maintenance; Section: 11 Emergency Response
(c) inspection of and reporting on the safety of equipment used at the mining operation for manufacturing, storing, transporting, and delivering explosives:	Section: 8 Compliance Certificates Registers Section: 6 Explosives Delivery and Storage Section: 7 Charging Equipment and Maintenance WAI-402-PRO-003 Handle and Transport Explosives
(d) the appropriate action to be taken to make safe the equipment mentioned in paragraph (c):	Section: 6.2 Delivery and Receipting of Explosives Section: 6.3 Access, Security and Capacity of Magazines Section: 6.4.1 Damaged or Deteriorated Explosives Section: 7 Charging Equipment and Maintenance

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
	WAI-402-PRO-003 Handle and Transport Explosives
(e) how explosives brought into the mining operation and used at the mining operation will be accounted for:	Section: 6.1 Explosives Used on Site Section: 6.2 Delivery and Receipting of Explosives Section: 6.3 Access, Security and Capacity of Magazines Section: 6.5 Inspections and Stock take
(f) how explosives will be checked for any deterioration in the explosives and isolated if they have deteriorated:	Section: Section: 6.4.1 Damaged or Deteriorated Explosives
(g) the establishment of secure storage for explosives at the mining operation, including a system for signing explosives in and out of storage:	Section: 6.2 Delivery and Receipting of Explosives Section: 6.3 Access, Security and Capacity of Magazines Section: 6.5 Inspections and Stock take WAI-402-PRO-002 Surface Magazine Operations WAI-402-PRO-003 Handle and Transport Explosives
(h) for underground mining operations and tunnelling operations, a process to remove explosives from underground at the operation unless there is an approved facility to store the explosives underground:	Section: 5 Explosives Use Section: 6 Explosives Delivery and Storage WAI-402-PRO-003 Handle and Transport Explosives
(i) the identification and control of hazards that may arise— (i) during the charging and firing of explosives; and	Section: 4 Risk Assessment Section: 5 Explosives Use WAI-402-PRO-003 Handle and Transport Explosives

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
(ii) in particular places, including, for example, in a storage bin feeder in which an explosive is to be used to clear a blockage:	
(j) the establishment of declared danger zones that no person may enter while blasting operations are taking place:	Section: 5 Explosives Use Section: 5.3 Firing
(k) the procedure to find, recover, and detonate misfired explosives:	Section: 5.7 Misfires WAI-402-PRO-007 Management of Misfires in Headings
(l) a record to be kept of misfired explosives:	Section: 5.7 Misfires WAI-402-PRO-007 Management of Misfires in Headings
(m) a register of people at or providing a service to the mining operation who— (i) are certified handlers under the Health and Safety at Work (Hazardous Substances) Regulations 2017; and (ii) hold a controlled substance licence under those regulations:	InTuition – Training database, has all records of certified handlers, the Explosives contractor has records of their employees with certified handlers
(n) the co-operation required between the mining operation and any person authorised under legislation regarding the safety of the storage, handling, transportation, and use of explosives at the mining operation, including compliance with any conditions attached to the authorisation of the person handling the explosive.	Section: 12.1.1 Contractor Management WAI-300-PLN-017 Contractor Management
Regulation 122: Explosives The mine operator must ensure that:	
(a) No person uses, handles, or issues explosives at the mining operation unless the person meets the requirements of an approved handler for the purposes of the Hazardous Substances and New Organisms Act 1996	Section: 9 Training and Competencies WAI-402-PRO-003 Handle and Transport Explosives
(b) Explosives used at the mining operation are	Section: Explosives Use

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
(i) Authorised for use by the mine operator (ii) Stable (iii) Fit for their intended use (iv) Insensitive to shock, sparks, friction, and the environment in which they will be stored, transported, and used (v) Simple to store, use, transport, and control	Section: 6 Explosives delivery and Storage Section: 13 Responsibilities and Accountabilities WAI-402-PRO-003 Handle and Transport Explosives
(c) Every person who designs or initiates a shot does so in a manner that ensures that the shot and any material expelled outside the declared danger zone do not cause injury to any person in, or in the vicinity of, the mining operation.	Section: 5.3 Firing WAI-401-PRO-002 Re-entry After Firing WAI-402-PRO-005 Development Charging WAI-402-PRO-009 Underground Firing WAI-402-PRO-006 Production Charging
In subclause (1)(c), declared danger zone means the area that no person may enter while blasting operations are to take place, established in accordance with the principal hazard management plan for explosives.	Section: 5.3 Firing WAI-401-PRO-002 Re-entry After Firing

Appendix F Principal Control Plan Waihi Emergency Management

Principal Control Plan

Emergency Management

Approved date: 5th October 2023

Document ID: WAI-250-PCP-001

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Department	**Health, Safety and Training – Site Operations**
Location/Site	Waihi

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Approved by	SSE/ UG Mine Manager	D. Townsend	03/10/2023
Approved by	SSE/ General Manager	J. Johns	05/10/2023

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Revision number	Revision date	Section	Page	Description	Effective Date
1.0	Mar 2016			Updated to OGNZL	16/03/2016
2.0		All	All	Remove Duty cards to form separate document, Add requirement for evacuation drills. Update security contact lists. IMT Support Contact List and Recovery Manager position removed and added to CIMS position packs. Update for reference to new Act and Regulations.	08/11/2016

Revision number	Revision date	Section	Page	Description	Effective Date
3.0	Dec 2017	All	All	Annual Review – Update the map on page 4, Updated firefighting plans in appendix. Remove contact list so it can be added as required to plan. Add delay in assessing injured person to TARP, the Hierarchy of Controls, included CIMS/IMT structure. Typo's. Alignment of table 2 & 8	24/01/2018
4.0	May 2018		1 & 77	Change UG Manager Signature Appendix N – Cyanide emergency procedures added from CN management Plan	26/07/2019
5.0	Jul 2019			Evase procedure removal from Appendices. Addition of UG firefighting resource as part of NZMRS review of EMPCP. Added helicopter incident TARP 1.22	26/07/2019
Draft	Sep 2019		69	Add Spill response plan for Class 5 Explosive	
Draft	Feb 2020		61/96	Added Explosive Blast Pressure, Distance Map, TARP – Explosive Fire Emergency	
6.0	May 2020		111/112	Edit Security Duty Card	03/06/2020
7.0	Jan 2021	14.5.5	25, 35/36,	Edit Security Duty Card, add to firefighting resources, Add Appendix E (Fixed Plant Gas Detection) and	

Revision number	Revision date	Section	Page	Description	Effective Date
			52, 58, 112	Appendix T (Mapping), Edit Emergency contacts, Add detail to section 10.6	
8.0	Mar 2022		All	Update helicopter incident TARP, Update security duty card contacts and format, General review	
8.1	Sep 2022	8.2	117, 118	Edit Security Duty Card	
9.0	Nov 2022	All	All	Template update, Approved by new SSE/GM	09/02/2023
10	Sep 2023	All	All	Full review, updated to include Bowtie Risk Treatment, updated Maps, Edit Emergency contacts, addition of WAH TARP	05/10/2023
10.2	Dec 2023		161,162	Removed Home & Work phone numbers to only show cell phone numbers and reformatted to fit Contacts on one page as per instruction; D Oliver	14/12/2023
10.A	August 2024	24.21	163	Minor Edit Adding Reg 104 requirement to appendix U within this PCP as requested by Third Party legislative audit (Peter Lowe)	01/08/2024
10.B	August 2024			Track Changes turned off	12/08/2024

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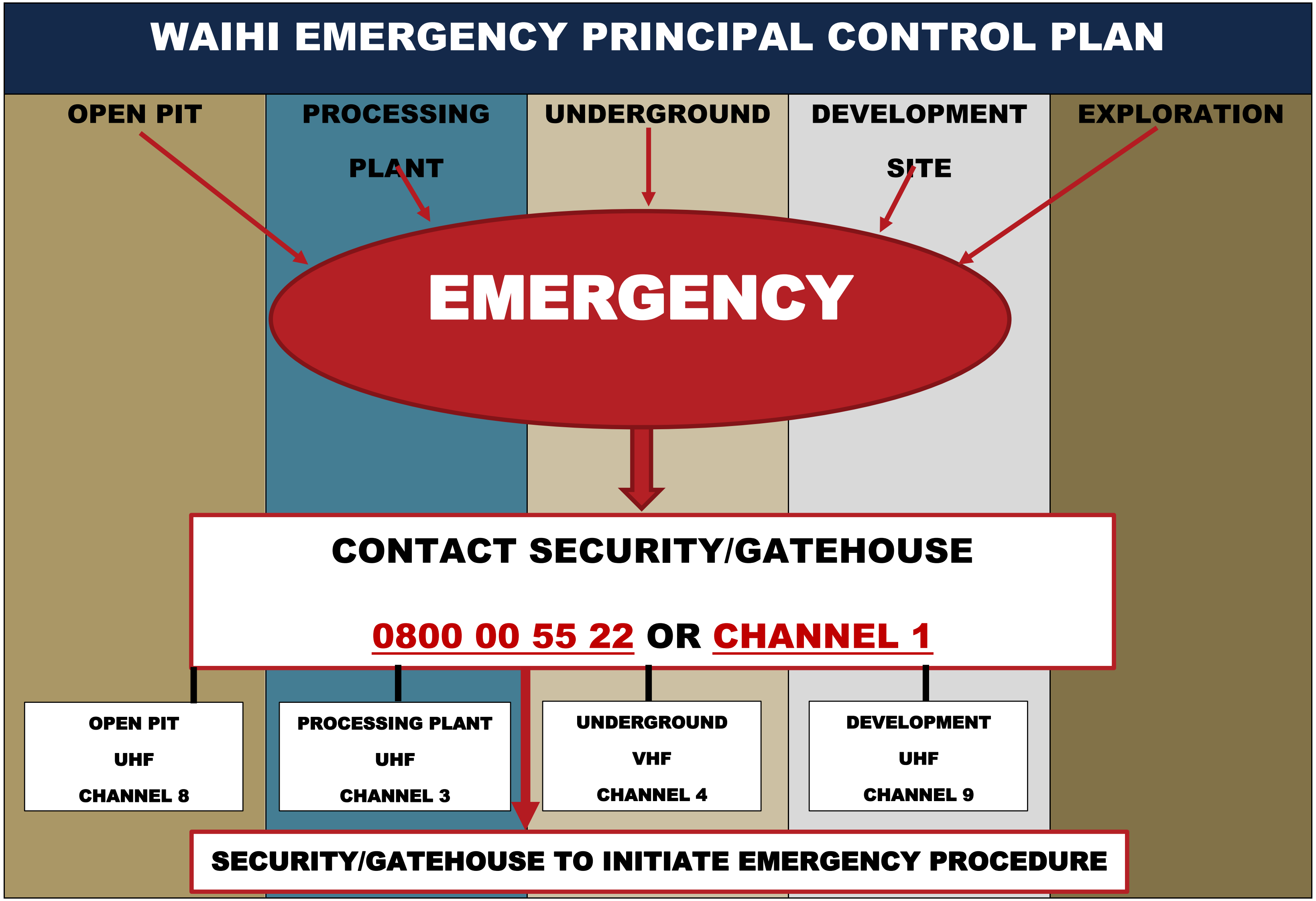
Distribution of Copies

Area - Location	Copy #
General Manager	1.
Health Safety & Training Manager	2.
Sustainability Manager	3.
Site Services Co-ordinator	4.
Moresby Ave – Reception	5.
Incident Management – Resource Kit – Moresby Admin	6.
Exploration Supervisor	7.
Education Centre	8.
Mines Rescue - Appliance	9.
Mines Rescue – Troup Carrier	10.
Emergency Response Advisor	11.
Mill Training Office	12.
Mill Training Office - Site Trainer	13.
Treatment Plant – North Muster	14.
Treatment Plant - South Muster	15.
Mill - Water Treatment	16.
Mill – Gold Room	17.
Mill – Control Room	18.

Area - Location	Copy #
Mill – Cyanide Storage Facility (Response Kit)	19.
Mill - Maintenance	20.
Stores	21.
Underground Manager	22.
Underground Safety	23.
Underground Tagboard Controller Box	24.
Incident Management – Resource Kit – UG Admin	25.
Underground Favona Admin	26.
Underground Workshop (Surface)	27.
Underground – Refuge Chamber - RC01 - 20 man	28.
Underground – Refuge Chamber - RC02 - 20 man	29.
Underground – Refuge Chamber - RC03 - 20 man	30.
Underground – Refuge Chamber - RC07 - 20 man	31.
Underground – Refuge Chamber - RC09 - 20 man	32.
Underground – 920RL Refuge Shelter - RC10 - 20 man	33.
Underground – Refuge Chamber - RC04 - 6 man	34.
Underground – Refuge Chamber - RC05 - 6 man	35.
Underground – Refuge Chamber - RC06 - 6 man	36.
Underground – Mobile Refuge Chamber - RC08 - 6 man	37.
Development Site Workshop – Muster Point	38.

Area - Location	Copy #
Development Site Whitehouse	39.
Open Pit - White House - Upstairs	40.
Open Pit – White House - Muster Point	41.
Security – Baxter Road	42.
Security – Grey Street	43.
Safe & Sound (Office)	44.
Fire Service - Waihi	45.
NZ Police – Waihi	46.
St Johns - Office	47.
NZ Mines Rescue Trust	48.
Enviro Lab	49.
Underground Crib room	50.
Underground – Refuge Chamber - RC11 - 6 man	51.
Underground – Refuge Chamber - RC12 - 6 man	52.


WAIHI EMERGENCY PRINCIPAL CONTROL PLAN
OPEN PIT
PROCESSING PLANT
UNDERGROUND
DEVELOPMENT SITE
EXPLORATION
EMERGENCY
CONTACT SECURITY/GATEHOUSE
0800 00 55 22 OR CHANNEL 1
OPEN PIT UHF CHANNEL 8
PROCESSING PLANT UHF CHANNEL 3
UNDERGROUND VHF CHANNEL 4
DEVELOPMENT UHF CHANNEL 9
SECURITY/GATEHOUSE TO INITIATE EMERGENCY PROCEDURE

1 PURPOSE

The purpose of the Emergency Management Principal Control Plan (PCP-EMP) is to:

- ensure all employees and contractors know how to respond in the event of an emergency;
- detail plans and procedures for potential emergencies;
- control or limit any effect that an emergency or potential emergency may have on site, on neighbouring areas or on transportation routes to the mine site;
- provide a basis for training and preparedness for all people likely to be involved in any emergency;
- control incidents and minimize their effects through the implementation of a coordinated emergency response by trained groups and individuals;
- ensure communication of all vital information relevant to an emergency as soon as possible;
- facilitate recovery and clean-up activities as soon as possible so that normal operations can be resumed; and
- ensure that the site emergency procedures are developed with due regard to the applicable Government Legislation.

2 SCOPE

This plan applies to all personnel and activities including to all persons in any capacity accessing the Waihi Mining Operation (inclusive of exploration sites). This plan has been reviewed and authorised by the Site Senior Executive (SSE) after consultation with local emergency service providers.

It has been developed with consideration of the limitations of Site emergency response capabilities and the identified potential need to use local emergency service providers to assist.

- the scope of the mine Emergency Management Plan (PCP-EMP) includes immediate response to and management of incidents on mine property
- On site co-ordination of emergency services and other response specialists
- The establishment of a system that enables all persons at the mine to be promptly located
- The provision of adequate rescue equipment, and
- That an adequate number of persons trained in the use of rescue equipment are available either on site or on call.

This PCP has been developed in conjunction with the following agencies and will be reviewed to facilitate the best possible response and outcomes:

- NZ Police (As changes arise)
- FENZ (As changes arise)

- St Johns Ambulance (As changes arise)
- New Zealand Mines Rescue Service (As per legislative requirement)
- WorkSafe New Zealand (As requested and as per legislative requirement)

3 REFERENCE AND COMPLIANCE

Level	Source
Legislation or Guidelines	• Health and Safety at Work Act 2015
	• Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016
	• Resource Management Act 1991 and associated regulations
	• Health and Safety at Work (Hazardous Substances) Regulations 2017
	• Mines Rescue Act 2013
	• Co-ordinated Incident Management System (CIMS)
	• Emergency Response Protocol: Underground Mines and Tunnels, 3rd edition
Corporate	• OGC-450-STD-020 OceanaGold Safety Performance Standards
	• OGC-450-STD-005 Integrated Management System Standards
	• OGC-450-GUI-005 Risk Management Guidelines
	• OGC-450-BWT-015 Emergency Preparedness and Response
	• OGC-460-PLN-001 OceanaGold Crisis Management Plan
Site	• Waihi Site Risk Register - SharePoint
	• WAI-300-GUI-001 Incident Management Team – Role Profiles
	• WAI-251-PLN-001 External Tactical Plan

Level	Source
	• WAI-251-PRO-007 Mines Rescue Emergency Response Procedure
	• WAI-251-PRO-012 Emergency eTXT Procedure
	• WAI-251-PRO-011 Waihi EMPCP Duty Cards
	• WAI-251-FOR-012 Emergency Scene Handover Form
	• WAI-350-PRO-042 Fire and Other Emergencies Involving Explosives
	• WAI-350-PLN-012 Waihi Tailings Storage Facilities Emergency Action Plan
	• WAI-420-PRO-005 UG Emergency Procedures
	• WAI-250-PRO-003 Emergency First Aid and Medical Treatment for Cyanide

4 RISK ASSESSMENT

The site risk register is to be reviewed after all significant incidents. Formal Risk Assessments (FRA) are to be undertaken where changes to this document affect safety of personnel. Risk Assessments are to be conducted according to OGC-450-GUI-005 Risk Management Guidelines.

Other risk assessments that are associated with this PCP have been referenced, where considered relevant, in the development of this PCP are referenced in documents recorded on OGL SharePoint.

A bow tie analysis was undertaken subsequently as a result of having identified Critical Risks in this WRAC. The summary of those risks and their critical controls are also listed below.

4.1 Risk Assessment Results Summary

4.1.1 Critical Risks (Unmitigated)

The following unmitigated Critical Risks were identified

- Site unaware of potential emergency situations/events
- Emergency situation/event not recognised by workers
- Emergency situation/ event not recognised by visitors

- Failure of emergency notification systems e.g., communication hardware or processes
- Physical resources not available or appropriate for workers to respond to emergency
- Inadequate MRT numbers, capability, or resources to respond to single or multiple emergencies
- Inadequate Incident Management Team (IMT) capability

4.1.2 Critical Controls

A critical control is a control that will have the greatest impact on preventing the risk(s) relating to the principal hazard from occurring, or if the risk was to occur the critical control would provide the greatest mitigation of the potential consequences.

The following Critical Controls were identified:

- Details of operation and hazards that could result in an emergency are identified and appropriate response defined, planned, and resourced
- TARPs are in place and communicated defining the minimum set of actions required in response to the potential development or escalation of an emergency situation
- Workers are trained in and use initial emergency response process appropriate to task e.g., first aid, use of fire extinguisher, basic rescue techniques
- Fixed facilities and movable emergency resources used by workers are identified maintained and located strategically to ensure availability when required e.g., first aid kits, rescue chambers
- Roles, numbers, and physical resource requirements for IMT are clearly defined and followed duty cards
- IMT personnel are trained and competent and maintain skills through participating in practice emergency exercises
- All persons are withdrawn to a place of safety and accounted for
- Emergency resources (e.g., Fire Fighting Resources, First Aid Kits, Trauma Kits and Emergency Pods) available at key locations throughout the site and adequate personnel are trained in how to use resources
- Equipment and PPE appropriate to the emergency is available and used by MRT personnel
- MRT personnel do not enter or withdraw from an emergency if the situation is outside the span of control
- Communication processes are followed to alert and provide information on actions needed by community.

A process has been implemented to ensure controls systematically identified and deemed critical to maintaining the integrity of PCP, are regularly conducted, thereby ensuring security and effectiveness of all measures. The Critical Control Check Sheet (CCCS) is the tool for regularly testing the effectiveness of internal procedures and controls.

The CCCS will be utilised at a frequency as determined by the Waihi Senior Management Team and will be based on the completed reviews and analysis of the principal hazard.

4.1.3 Other Risk Treatment Controls

The remainder of the risks identified in the Site Risk Register were not considered Material or Critical if unmitigated however still presented a threat to health and safety of personnel. Refer to the Site Risk Register for full detail.

- All foreseeable emergencies have been identified and risk assessed with input from technical staff, operational staff, the Health, Safety and Training department and Health and Safety committee
- To mitigate the risks around emergency management associated controls clarified
- For each major event identified there is a corresponding trigger action response plan to show when the incident escalates and what action needs to be taken
- All rescue capabilities were established and documented to ensure the any accident or major incident is responded to safety and efficiently.

The following foreseeable emergencies are summarized in the table below:

Table 1: Foreseeable Emergencies

	Foreseeable incident / accident	Potential location	Internal response required	Casualty management outcome	External services provided
1.	Serious incident on / off site (Including fatality)	All areas	MRT and site medics, first aid responders, IMT initiated, CMT Initiated	Burns, personnel trapped behind fire, smoke inhalation entrapment, electrocution, crush injuries, personnel buried, machinery entrapment, fall from height	Police, Ambulance, Hospital, Fire service
2.	Multi casualty Incident (Including fatality)	All areas	MRT and site medics, first aid responders, IMT initiated, CMT Initiated	Burns, personnel trapped, electrocution, personnel buried, vehicle/machinery, entrapment, crush injuries, fall from height	Fire, Police, Ambulance, Hospital,

	Foreseeable incident / accident	Potential location	Internal response required	Casualty management outcome	External services provided
3.	Fire – surface buildings, bush / vegetation, tyres and or machinery	All surface areas	MRT and site medics, first aid responders, ERT fire appliance, water carts, fire extinguishers, IMT initiated	Burns, personnel trapped behind fire, smoke inhalation	Fire, Police, Ambulance, Hospital,
4.	Fire – Machinery / Tyre Fire	All areas	MRT and site medics, first aid responders, MRT fire appliance, water carts, fire extinguishers, IMT initiated	Burns, personnel trapped behind fire, smoke inhalation	Fire, Police, Ambulance, Hospital, NZMRS
5.	Fire underground, vehicle, tyres, electrical	Underground	MRT and site medics, first aid responders, MRT fire appliance, water carts, fire extinguishers, IMT initiated	Burns, personnel trapped behind fire, smoke inhalation, property damage, power outage	Fire, Police, Ambulance, Hospital, NZMRS
6.	Weather event	All areas	MRT and site medics, first aid responders, IMT initiated	Multiple casualties, persons trapped, crush injuries, major trauma	Fire, Police, Ambulance, Hospital, Civil Defence
7.	Tailings impoundment failure	Development Site Tailings Dam	MRT and site medics, first aid responders, IMT initiated	Multiple casualties	Fire, Police, Ambulance, Hospital, Environment Waikato, Civil Defence

	Foreseeable incident / accident	Potential location	Internal response required	Casualty management outcome	External services provided
8.	Mining-vehicle accident (Vehicle collision persons trapped, pedestrian interaction)	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel buried, trapped in vehicles, crush injuries, personnel isolated	Fire, Police, Ambulance, Hospital
9.	Explosive's emergency	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel trapped, unconscious, inhalation of gases	Fire, Police, Ambulance, Hospital
10.	Explosives Fire Emergency	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel trapped, unconscious, inhalation of gases	Fire, Police, Ambulance, Hospital
11.	Major pit wall failure	Surface open pit	MRT and site medics, first aid responders, IMT initiated, CMT Initiated	Personnel buried, trapped in vehicles, personnel isolated head injuries, crush injuries, major trauma incidents	Fire, Police, Ambulance, Hospital
12.	Major strata failure - earthquake	All areas	MRT and site medics, first aid responders, IMT initiated CMT Initiated	Personnel buried, trapped in vehicles, personnel isolated head injuries, crush injuries, major trauma incidents, heart attack	Fire, Police, Ambulance, Hospital, Civil Defence
13.	Entrapment	All areas	MRT and site medics, first aid responders, IMT initiated, CMT Initiated	Personnel buried, trapped in vehicles, personnel isolated head injuries, crush injuries, major trauma incidents, heart attack	Fire, police, ambulance, hospital, NZMRS
14.	Flooding	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel trapped or injured	Fire, Police, Ambulance, Hospital

	Foreseeable incident / accident	Potential location	Internal response required	Casualty management outcome	External services provided
15.	Process plant - chemical spill and/or gas leak	All areas	MRT and site medics, first aid responders, IMT initiated	Entrapment personnel isolated, crush injuries	Fire, Police, Ambulance, Hospital
16.	Confined space incident	All areas	MRT and site medics, first aid responders, IMT initiated	Drowning, hyperthermia, chemical exposure, personnel isolated, Loss of consciousness	Fire, Police, Ambulance, Hospital
17.	Explosion	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel buried, trapped in vehicles, personnel isolated head injuries, crush injuries, major trauma incidents, heart attack, burns	Fire, Police, Ambulance, Hospital
18.	Missing persons	All areas	MRT and site medics, first aid responders, IMT initiated	Unable to locate personnel	Fire, Police, Ambulance, Hospital
19.	Inundation or inrush	All areas	MRT and site medics, first aid responders, IMT initiated	Drowning, hyperthermia, personnel isolated, entrapment	Fire, Police, Ambulance, Hospital, NZ Mines Rescue
20.	Vehicle Collision – Persons Trapped	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel trapped in vehicles, crush injuries, personnel isolated	Fire, Police, Ambulance, Hospital
21.	Violence / Bomb threat	All areas	MRT and site medics, first aid responders, IMT initiated	Security compromised, personnel trapped, injuries	Fire, Police, Ambulance, Hospital
22.	General Illness	All areas	MRT and site medics, first aid responders, site	Sickness, heart attack, medical conditions	Fire, Police, Ambulance,

	Foreseeable incident / accident	Potential location	Internal response required	Casualty management outcome	External services provided
			nurse, IMT initiated		Hospital
23.	Helicopter Emergency	All areas	MRT and site medics, first aid responders, IMT initiated	Personnel trapped in aircraft remote location, fire, crush injuries, personnel isolated or missing	Fire, Police, Ambulance, Hospital, Land SAR, Police SAR, Skyworks
24.	Security Breach	All areas WKP/Exploration	MRT and site medics, first aid responders, IMT initiated, External Communications Advisor	Security compromised, personnel trapped, injuries	Fire, Police, Ambulance, Hospital

5 WAIHI SITE

Due to the large scale of the various operations over a number of site locations it is important to describe the exact location of an accident or emergency so that assistance and emergency services can respond quickly.

The PCP-EMP includes the following areas:

- Martha pit;
- All Tailings Storage Facilities (TSF1A, TSF2);
- All roads, parking areas and operational working areas;
- Baxter's Rd processing areas, including WTP and associated infrastructure;
- All underground areas;
- All exploration activities; and
- Potential to be called to assist local emergency services near to the Waihi area.

5.1 Coordinated Incident Management System (CIMS)

Waihi Operation has incorporated the CIMS model in this plan to establish a modular and scalable framework for consistent response to any level – from a single agency response to a larger, multiagency response that may require co-ordination at the community or incident level or higher. CIMS enables agencies to plan for, train and conduct responses in a consistent manner, without being prescriptive.

The purpose of CIMS is to achieve effective coordinated incident management across responding agencies by:

- Establishing common structures, functions and terminology used by agencies in incident management, yet within a framework that is flexible, modular, and scalable so that it can be tailored to circumstances specific to any level or type of incident; and
- Enabling agencies to develop their own processes, procedures, and training for the execution of CIMS
- For the purposes of CIMS, an emergency is defined as a situation that poses an immediate risk to life, health, property, or the environment that requires a coordinated response.

The components of emergency management are referred to as the '4Rs'. They are:

- Risk reduction;
- Readiness (to respond);
- Response; and
- Recovery.

CIMS is applied during response, and therefore must be factored into readiness.

5.2 Emergency Priorities

OceanaGold is committed to creating and maintaining a safe and productive work environment. If an emergency situation arises the order of priority is:

1. To reduce and eliminate danger to people
2. To reduce and eliminate environmental damage
3. To minimize damage to plant and equipment, loss of material and loss of production

5.3 Manning Levels

The number of personnel on site at any given time can vary greatly. The numbers below are indicative of normal maximum numbers expected to be on site at these times.

Daytime Mon - Fri	Night & Weekends	Plant Shutdown Days
150	**60**	**200**

5.3.1 Emergency Response Manning (MRT)

Emergency manning is set up to have a minimum of 12 x MRT responders (two teams of 6) within twenty minutes of notification available to respond when mines rescue pagers are activated.

Target department manning levels:

- **Underground**: 15 x Mines Rescue Team Members.
- **Surface**: 15 x Mines Rescue Team Members

5.3.1.1 Surface response level

There are trained and competent personnel on surface at all times to conduct initial emergency response. They are to raise the alarm, carry out evacuation duties and take any necessary steps to keep workers safe.

5.4 Activating the Mine Rescue Protocol

NZ Police have developed an SOP which sits in their system for their communications team to activate in the event of a major underground emergency at **232 Baxter Rd, Waihi**.

This is activated by calling **111** and notifying police there is a level 3 emergency underground. This is typically done by the Mines Incident Controller (MIC) or Incident Controller (IC)

The **111 call** should be scripted in advance and readily available for the person making the call. There should be a clear directive that instructs the **caller to ask** for the "**POLICE"**. The following script has been consulted and agreed with Industry members, New Zealand Police, WorkSafe NZ and NZ Mines Rescue Service: ***"We have a major underground mining emergency at the Waihi Mine Site. Please activate the <u>Underground Mine and Tunnelling Operations Emergencies</u> SOP "***

The NZ Police representative will ask further questions in order to obtain as much information as possible to confirm that there is in fact, a major underground mining emergency and that the Police SOP is to be activated. Mine operators are to give as much information as possible, including the fact that there are multiple personnel unaccounted for, or accounted for and trapped.

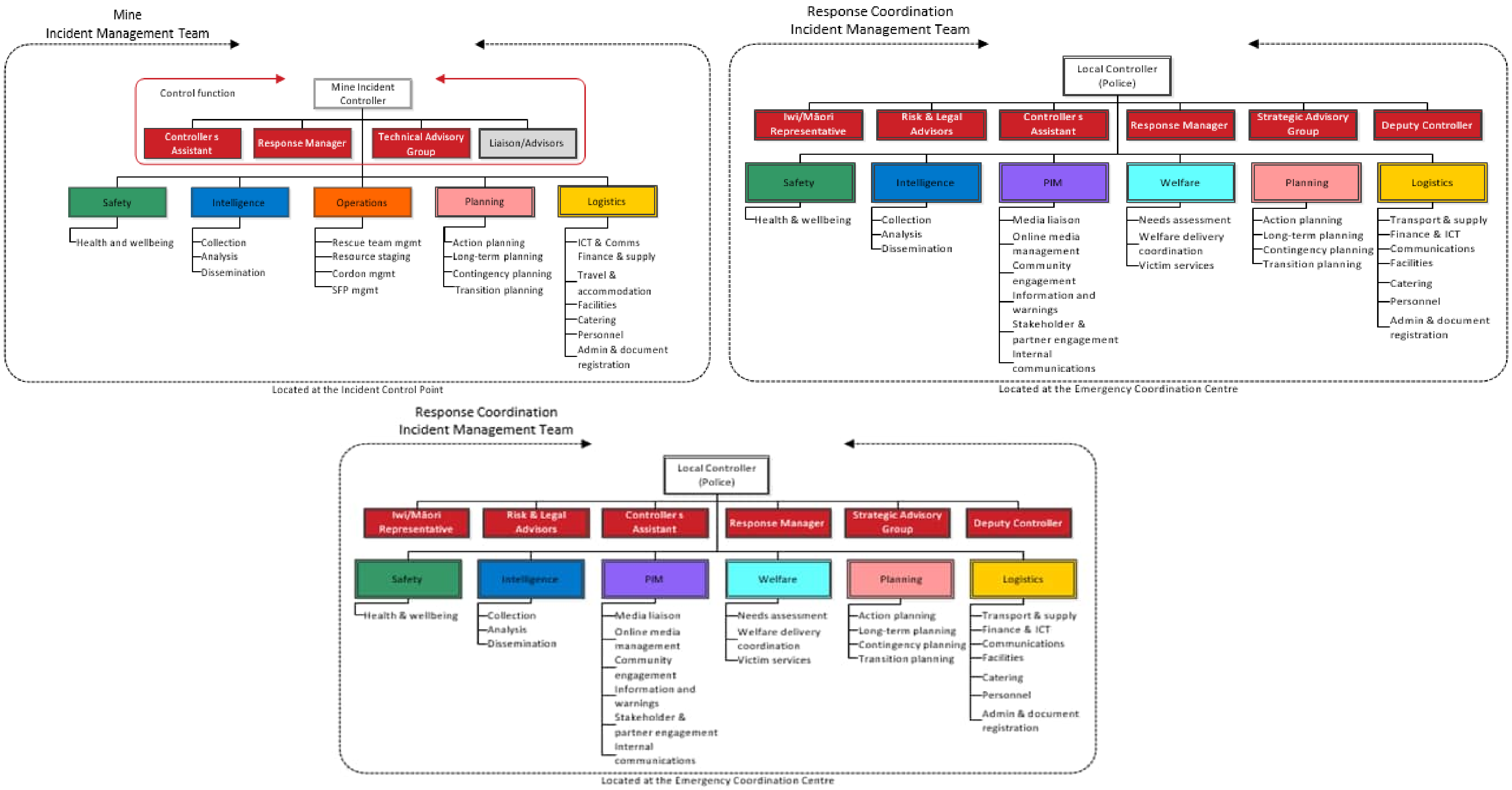


Figure 1:Underground Mines Emergency Protocol V3 (April 2022)

6 OGL CRISIS MANAGEMENT INTERFACE

The interface between this PCP and the Corporate Crisis Management Plan is critical to handling very serious incidents. If incidents grow in complexity and scale, the responsibility for directing the company's overall response may shift to higher levels in the organization.

This escalation in responsibility is necessary because the response may require provision of national or international expertise and equipment, may become the focus of media attention, and may require increased funds and management to address a wider range of environmental, social, and economic consequences.

This Crisis Management Plan (CMP) is designed to assist in protecting OGC from the corporate consequences of a crisis event, whether sudden (emergency) or escalating in nature, by ensuring prompt and effective handling of the strategic, contractual, and public image aspects arising.

Corporate Crisis Management is activated by the SSE or Mine Incident Controller when a situation involves or has the potential to involve any of the following:

- Threatens the safety, health and wellbeing of our employees, contractors, neighbouring communities, or the public at large.
- Significantly affect the company's ability to carry out its business.
- Damage the company's reputation, threatens the environment.

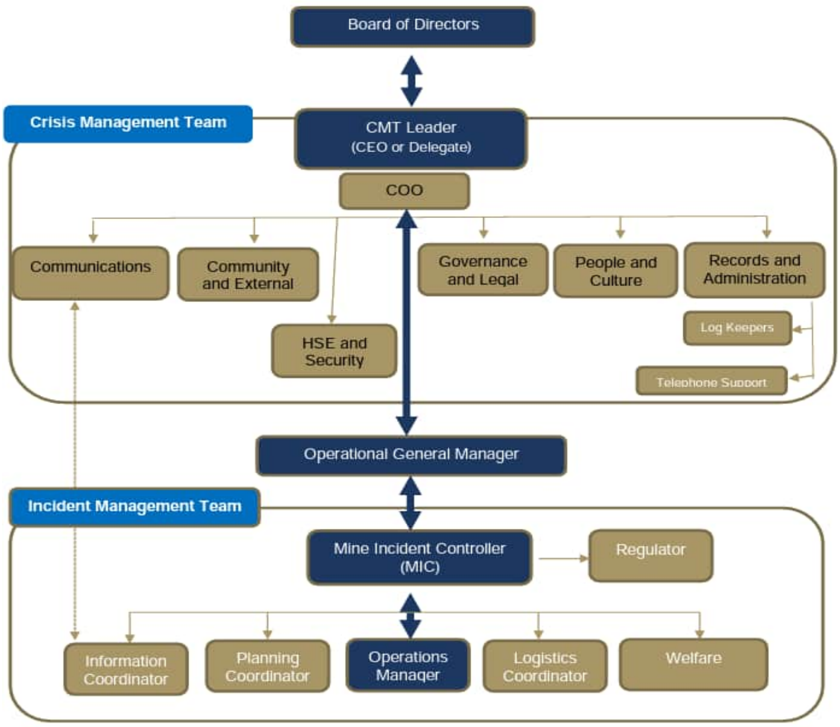


Figure 2: Crisis Management Team

7 EMERGENCY MANAGEMENT AND RESPONSE DOCUMENTS

There are several key documents that form part of the emergency management processes at Waihi Operations.

These documents are designed to complement the Waihi emergency management processes, in line with OGC requirements. Practical and desktop exercises are carried out to make sure all relevant personnel have adequate knowledge of these documents. Exercises are carried out with a frequency that ensures that the EMP can be rapidly, effectively, and safely activated and implemented.

The critical documents are outlined below.

7.1 Duty Cards

Duty Cards are designed for specific IMT CIMS roles and responsibilities and are dependent on emergency type and actions required. These are individually issued to role holders in a pack and are also located at the Site Incident Control Points (ICP). These duty cards are also part of the IMT briefcases located at UG reception and Moresby reception.

Trigger Action Response Plans (TARPs)

TARPs outline what processes should be followed for specific incidents and what changes as the level of emergency increase.

These documents are specifically designed to assist everyone involved in the emergency to react quickly safely and decisively. These TARPS are available in key locations.

These are located at Site ICP's, and copies are held as an appendix to this document.

NOTE: All key documents are to be stored in incident control points located across site.

8 INITIATING AN EMERGENCY

8.1 Emergency Calls

Site security guards are the first receivers of an emergency radio call or phone call via the emergency number, a request for mines rescue, emergency services or for the site medic.

8.1.1 By Radio

1. State "EMERGENCY, EMERGENCY, EMERGENCY"
2. State your name and nature of the emergency
3. Give location of incident, type of incident, number of injured, directions to incident and assistance required.
4. Have message repeated back to you
5. Stay by two-way radio/phone if you are not required at the incident

8.1.2 By Phone to Waihi Emergency Number

- Waihi Emergency Number 0800 00 55 22 and follow steps 2 - 5 above.
- Answer the operator's questions and do not hang up until told to do so.

8.2 Person Discovering an Emergency

1. **IMMEDIATELY** make an emergency call on **0800 00 55 22**, giving the nature and location of the emergency and follow the instructions given by Operator. If you have a two-way radio in your vehicle - **USE** Channel 01 Emergency Radio Channel.
2. **DO NOT PLACE YOURSELF IN DANGER**.
3. You may decide to take some remedial action, e.g., extinguish a small fire, control bleeding, or turn off an energy source.
4. **REMAIN CALM** and assess the situation
5. **ADMINISTER FIRST AID** if required and/or report requirements using the phone or two-way radio

8.2.1 Response Levels

Each TARP has up to 3 levels of response:

- level 1 – contact area supervisor – ensure safety of all personnel
- level 2 – contact senior management (May require external emergency service providers)
- level 3 – contact senior management (Will require external emergency service providers)

Table 2: Response Levels

Level 1	Level 2	Level 3
Localized response by mine staff with own resources	**Full turnout of MRT team. External support on stand-by or mobilized**	**External assistance mobilized**
Injury or incident requiring first aid treatment No further threat or danger of escalation Damage affecting and not halting mine operations Injury or incident requiring personnel to exit mine Mines Rescue Team informed / on standby and mobilized if required.	People seriously injured Personnel are trapped or missing under hazardous conditions Further threat or danger of escalation Mines Rescue Team activated, put on standby Damage to mine safety systems SSE or delegate notified Incident Management Team may be activated May require assistance of external emergency service providers External support (e.g., WorkSafe, MRS or Police) may be brought into the IMT to assist the MIC.	Notify SSE A major level incident that may result in multiple fatalities and/or trigger significant public interest. Potential duration of operation is beyond 2-3 hours. Personnel trapped or seriously injured with high level of risk Increasing complexity, duration and consequences (out of control) Of national concern / media interest Serious damage to safety systems Emergency Management Plan initiated and may escalate to Corporate Crisis Management Plan.
		External emergency service providers assistance required
		NZ Mines Rescue mobilized
		Need for strategic advice and potential for additional resources beyond the capacity of the mine operator.
		Initiate Underground Mines Rescue Protocol for underground level 3 emergencies.

9 FIRST RESPONSE

First Response is defined as immediately available site assistance and incorporates: Any level 1 and level 2 triggers that can be safely dealt with using immediately available onsite personnel. This response can be backed up by MRT members if required and involves minimal outside assistance such as ambulance transport.

The Emergency First Response includes:

- BLS (basic life support) CPR at the workplace first aid level
- AED (automated external defibrillator) use (optional)
- preventing and caring for shock
- spinal injury management
- use of barriers to reduce disease transmission risk
- basic first aid: illness & injury assessment, bandaging, management of fractures & dislocations, and first aid kit considerations
- basic firefighting capabilities
- Reconnaissance: information gathering, state of situation, key information to assist decision making.

9.1.1 Site Security

Site Security Guards are the first receivers of an emergency radio call, a request for mines rescue, 111 phone call or a request for the Site Medic.

Security has relevant Duty Cards to prompt the critical first responses to specific incidents (Refer to Security Guard Duty Card and flow chart appendices)

These are designed to be used by the Emergency Call Takers to ensure that vital notifications and actions are not missed during the initial part of an emergency situation.

9.1.2 Back up Response

Back up response is defined as external emergency service involvement and/or IMT activation:

- any level 2 trigger where first response has been ineffective and immediate advice and support is required from OceanaGold personnel who are not on site at the time;
- any trigger which requires evacuation of an area, major external emergency service involvement or the forming of the Incident Management Team;
- all level 3 response triggers

9.1.3 Incident Management Team (IMT)

The Incident Controller (IC) will assemble the Incident Management Team based on the information they receive. The IC will declare the incident a level 3 if required and follow the appropriate steps.

Guidance on when emergencies escalate from levels 1, 2, or 3 can be referenced in the Trigger Action Response Plans and Risk Assessment Guidelines.

9.1.4 Incident Control Points (ICP)

This refers to various different rooms located around site that will be used as an emergency control room for the duration of an emergency. The one used will depend on the location and type of emergency.

Waihi Incident Control Points are as follows:

1. **Moresby Ave**
   - Moresby Ave Royal Room
   - Moresby Ave Empire Room (breakout room)
2. **Baxter Rd – Mine Site**
   - UG Favona Chase Meeting Room
   - Baxter Rd Training Room

9.1.5 Mine Security

In an emergency event the IMT may need to secure the mine site. At a site level there are actions in place to ensure no unauthorized persons can enter the mine. If this is to be a longer-term action the involvement of the local police will be initiated.

The Incident Controller will organize security points as inner and outer cordons depending on the emergency situation.

Upon level 3 incidents being declared the Police will assist in securing the Waihi Operations. This will include but is not limited to:

- Roadblocks on public roads;
- Block and man security gates to prevent unwanted entry;
- Close roads public and private if required; and
- Evacuate surrounding properties if required.

10 EMERGENCY COMMUNICATIONS

10.1 Communications Surface Operations

10.1.1 Telephone

The primary mode of communication is by telephone.

- Dial **0800 00 55 22**

In the event of a power failure and subsequent PABX failure there is still a mains-fail phone operating at Security, powered by the backup generator.

- Dialling **0800 00 55 22** internally will put you through to the Security emergency phone.

10.1.2 Mobile Phones

- Mobile phone reception is generally reliable on site but can be erratic in certain locations. (Be aware of intermittent mobile reception at Baxter's Rd Security Gate).
- Mobile phones should not be solely relied upon for emergency contact.

10.1.3 Radio Telephone (RT)

- Communication with mobile personnel, field workers and operators in the mines, Development Site and plant areas can also be made via the handheld RT.
- Personnel either carry hand-held RT's or have access to vehicle installed RT units. All the Waihi Operations vehicles are fitted with RT's.
- These radio channels are recorded for incident and emergency investigation post event purposes.

10.1.4 Radio Channels (UHF)

Table 3: Radio Channels (UHF)

Channel	Purpose
Channel 1	Emergency calls
Channel 3	Surface Mill control channel
Channel 4	Surface Maintenance chat channel
Channel 8	Surface Open Pit
Channel 9	Surface Development Site

10.2 Communications Underground Operations

10.2.1 Radio Channels (VHF)

The main form of communication underground is via radio on the following channels:

Table 4: Radio Channels (VHF)

Channel	Purpose	Area Covered
Channel 1	Emergency	All
Channel 2	Underground chat channel	Underground
Channel 3	Surface UG Shift Supervisor Office	Underground
Channel 4	General	Underground
Channel 5	Underground Workshop	Underground

10.2.2 Underground Telephone Communication

Telephones are located in all refuge chambers, except for the portable refuge chambers. Telephones are generally used during an emergency for phoning in your location when you have evacuated to refuge chambers.

10.2.3 Stench Gas

The Waihi underground mine has an emergency stench gas system that is utilized to warn personnel of the need to evacuate. Release of stench gas will be determined and arranged by the emergency Underground Tag Board Controller. The release points are at the tag board (button), mill control (SCADA) or each unit has a manual release valve.

10.2.4 Radio Silence

All personnel not directly involved in an emergency should maintain radio silence, unless requested to do otherwise.

After the emergency has ceased, the Underground Tag Board Controller, Chief Warden or Mine Incident Controller is to announce over the RT that the emergency has ended, and normal radio traffic may resume.

10.3 External Communications & Consultations

The Senior Site Executive will ensure the existence and maintenance of this PCP and that an overview of the content of the Plan is communicated to all site personnel, including contractors, who are required to undertake work in the Waihi operational areas.

The processes shall ensure that operators are provided with an understanding of emergency management control methods, related issues/incidents, and any relevant changes in procedures prior to implementation.

11 EVACUATION

11.1 Surface Operations

There are two types of evacuation dependent on the emergency:

- Local evacuation to a muster point
- Complete Mine site evacuation to an alternative control point

11.1.1 Muster Points

When an evacuation of a specific area is signalled all personnel must vacate the defined area and proceed to the relevant Muster Point. The area will be secured in an appropriate manner and sentries placed to prevent access to the area. The Chief Warden must account for all employees, contractors, and visitors. Duty cards are located at the Muster Points for Warden Duties (e.g., Emergency Services Escort duties and Bridge Traffic control.) Refer to appendices.

11.1.2 Site Evacuation

When a site evacuation is signalled, every person on site must go to one of the muster points and be accounted for. Personnel names and Company contacts that are registered as on site are available by requesting a current site numbers list from Security. The Incident Controller must account for emergency responders.

When moving to an evacuation point, care must be taken to avoid moving into a potentially hazardous situation. Take note of where the emergency is and move away from the area, taking particular note of wind direction as indicated by one of several windsocks located around the sites.

Large chemical emergencies at the Processing Plant may require complete evacuation from Site. This will mean mustering at either; Baxter’s Road Security Gate, Clarke Street gate, Moore Street gate or Barry Road gate depending on wind conditions.

If this does become reality, then some Mine arranged Transport will be required to relocate affected personnel to another designated control point (e.g., Moresby Ave offices, or Education Building).

This will be determined through an Incident Action Plan (IAP) from the Incident Management Team (IMT).

If it is likely that the emergency may affect the surrounding Waihi community residents, then the ICP may be located in an available breakout room at the Moresby Ave office.

NZ Police are responsible for any evacuation outside of the mining licence/permit area.

OGL may also become involved in chemical spill clean-up off site, either for advice on how to treat or for requests for neutralizing agents such as oxidizing agents in the case of a cyanide spill.

Control of external roads and vehicle movement is the responsibility of the NZ Police. Waihi Operations has a responsibility to prevent people entering a hazardous environment hence in an emergency situation it may be necessary to establish roadblocks on public roads prior to the NZ Police arriving on the scene.

The control of such roadblocks would be handed over to the NZ Police upon their arrival.

An evacuation will be communicated via:

- Mines - over the Mine RT system (including U/G RT system)
- Processing Plant – Mine RT system or the evacuation siren

11.1.3 Explosives Magazine Emergency Evacuation

In the event of an emergency evacuation involving explosives magazine, the Explosives PHMP will be utilised and followed where applicable in regard to all aspects of storage, handling and use of explosives.

Reference:

WAI-400-PHM-007 Explosives PHMP

11.1.4 What to Do When You Arrive at an Evacuation Point

Trained Muster Wardens or the most senior representative from Waihi Operations, at each muster/evacuation point are allocated and one will assume the role of ‘Chief Warden’. It will be the responsibility of each Muster Warden to take a head count and communicate via the RT with the nominated Chief Warden.

On arrival at a muster/evacuation point all personnel are to remain at the muster/evacuation point until advised otherwise by the Chief Warden via the Muster Warden.

NOTE: “All personnel” includes all employees, visitors and contractors that were present on site at the time the evacuation was called.

The Muster Wardens must be able to account for all visitors and contractors who have signed in via Cardax entry through the Security gates.

In the event of an evacuation at the Moresby Ave office or the Education Centre, then refer to the building specific plan.

The Muster Wardens must be able to account for all visitors and contractors who have signed in at reception offices.

11.2 Underground Evacuations

There are two evacuation scenarios for underground:

- Evacuation to refuge chambers
- Evacuation to surface

Depending on the reason for the evacuation, it may be signalled either by radio, stench gas or a combination of both.

All UG personnel shall follow the requirements of WAI-420-PRO-005 UG Emergency Procedures.

11.2.1 Refuge Chambers

The underground mine has multiple refuge chambers strategically placed throughout to ensure a point of refuge is available to personnel should an emergency situation arise. They vary in size from being able to accommodate 6 personnel to 20 personnel. The placement of these depends on the number of personnel that may be in that work area. Mobile refuge chambers are also used to prevent entrapment of personnel in work areas or when needed as per mining requirements.

All refuge chambers are connected to mine air and have either radio communications or telephone communication capabilities or both. Locations of refuge chambers are printed on the shift plan and on maps. Hard copies of the Mine map are located in the Mines Rescue station and digitally on the local network. The SharePoint also has an up-to-date mine plan at all times.

11.2.2 Escapeways

When a safe path of egress is blocked an escapeway can be used to exit to a place of safety. Escapeways are spaced strategically on levels to ensure personnel can utilize them should an emergency situation arise.

There is an exit along the 920 level that leads to a point of refuge in the open pit, therefore out of the underground mine should the portal become compromised. From this location Mine Rescue will organise removal of personnel to the surface.

11.2.3 Self-Rescuers

All personnel entering the underground mine will carry a self-contained self-rescuer on them at all times. This is to be used when an irrespirable atmosphere arises. Each self-rescuer is inspected before use and formally every 12 months, this includes a pressure check to ensure the integrity of the self-rescuer.

11.2.4 Accounting for Personnel

Every person on site must be accounted for in the event of evacuation including employees, contractors, and visitors.

Waihi operations operates a CARDAX system, and all visitors and un-inducted persons must sign in and out at Baxter Rd Security and Moresby reception every time they visit.

Underground visitors will also be required to be logged in via the visitor’s book located in the Technical Services / Reception area. They will also be tagged on with their allocated Underground guide.

11.2.5 Methods of accounting for personnel

Waihi mine operation is spread out over a large area. To ensure all personnel on site can be accounted for, the following personnel accounting methods are used:

- CARDAX – an electronic card system used to enter all active mining areas. This requires an authorized access card to enter these locations. A report can be run from various locations which will identify where and when personnel have entered the mining areas.
- Underground areas have a visitors sign in and sign out book located at the Reception area.
- Simbio records show Shift attendance, locations and activities for the current shift.
- Underground and Waihi North Helipad tag boards.

Dependent on the situation a combination of the above accounting methods may need to be implemented.

11.2.6 Employee Emergency Contact Records

All employment records are kept in the People & Culture management data base (Success Factors) complete with details of emergency contacts for all employees working at Waihi mine sites.

Contractor emergency details are also stored in the Site CARDAX system with their induction records.

The contractor's site principal representative will contact their employer for emergency details.

11.2.7 Trial Evacuations

Trial evacuations are to be conducted periodically to test the Emergency Response Plan and to ensure that employees have an understanding of their requirements. These trial evacuations events are recorded and entered in InControl (INX).

12 EMERGENCY RESPONSE CAPABILITIES

Waihi Operation has set up its own emergency response capabilities to respond in an emergency situation. Capabilities and competencies covered in the emergency response training for Mines Rescue Team (MRT) members are as follows:

- Full medical upon joining, and annual 12-month health assessment
- Annual fitness test – minimum requirement for fully operational MRT members
- BG4 and SCBA breathing apparatus training
- Vertical Rescue (At height and Depth)
- PHEC (Pre-Hospital Emergency Care) medic training
- High Pressure lifting bag operations
- Vehicle extrication
- Underground search and rescue
- Underground and Surface fire response
- HAZMAT response
- Confined Space rescue
- Exploration bush rescue

Competency levels are put in place to ensure emergency response personnel have the correct level of training.

12.1.1 First Aid Arrangements

Waihi operations will ensure that training is providing to ensure that someone is on site at all times with first aid capabilities. Waihi operations ensure an appropriate number of their staff are trained in workplace first aid.

The site medics are trained to PHEC level. Authorised Site Medic are able to administer pharmaceuticals under the Standing Order. Records of these qualifications are held in INX InTuition.

The mine has a fully equipped first aid room and a 4WD ambulance to transport patients if required.

12.1.2 Inspections on Emergency Response Capabilities

Area inspections are required to be carried out across the site ensuring that all emergency equipment is in place, up to date and in working order.

The following areas are required to be inspected on a regular scheduled basis:

- Underground refuge chambers
- Underground trauma packs
- Underground rescue BG4 SCBA units
- First Aid Room
- Fire extinguishing systems (including sprinklers and deluge systems)
- Open Circuit SCBA units
- Firefighting equipment including Hydrants and Extinguishers
- Cyanide Treatment Kits
- MRT response vehicles
- MRT response trailers
- MRT rescue station

13 INCIDENT MANAGEMENT

13.1.1 The CIMS Functions

Response to incidents requires a wide range of information to be analysed and activities to be carried out. Waihi Operations IMT structure is based on the CIMS emergency management model. The resulting tasks and responsibilities are spilt up into seven main functions to enable multiple departments with assistance from external agencies to coordinate resources effectively and make it easier for their personnel to work alongside each other. The following Incident Management Team (CIMS Based) Table shows the main functions of the IMT.

All the CIMS functions need to be considered at an incident, whether they are carried out by a single person in charge of a small response, or by teams of personnel in a major response. Departments may condense or amend the functions to suit their requirements and the specific objectives for a particular incident.

The responsibilities for each of the functions are summarized in the table below:

13.1.2 Incident Management Team (CIMS Based)

The onsite incident management team is based on the CIMS structure plus additional site roles have been defined to support these roles, refer to the diagram below. An overview of roles and responsibilities is listed in Table 7: CIMS Roles and Responsibilities following; however, these roles are defined in the guideline WAI-300-GUI-001 Incident Management Team – Role Profiles.

The MIC will determine which site roles will be required depending on the type of response and the setup for the initial phase.

The site role profiles are a guide, roles are at the direction of the MIC as required.

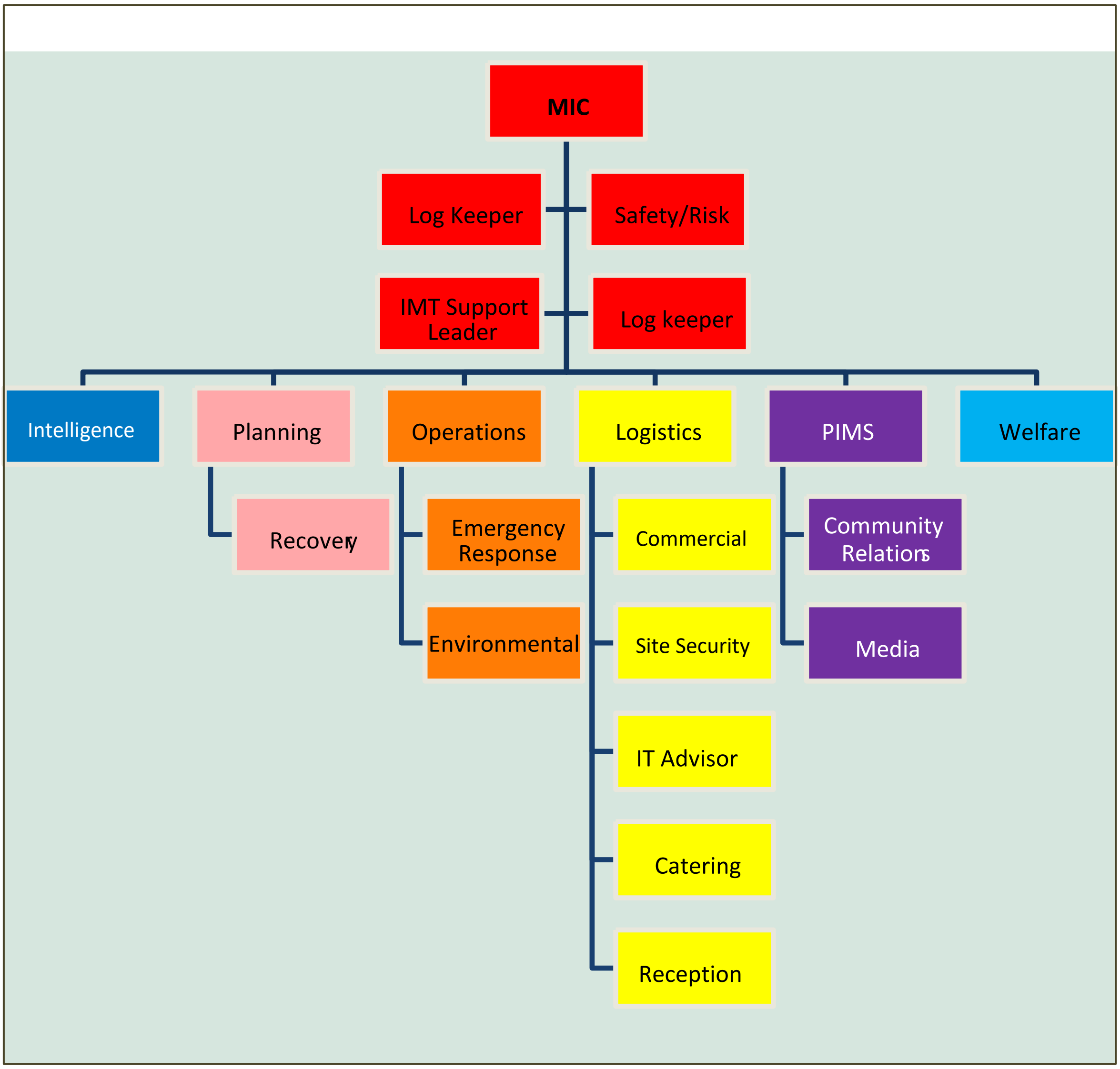


Figure 3: CIMS structure

13.1.3 Incident Management Team Resourcing

Resourcing of emergency management capabilities is to be reviewed every year during the budget planning by each department and overall, by the HST Manager.

This will include any major capital works or equipment that needs to be purchased or updated and also include what training will be required both internally and externally.

Other resources required are:

- pre-determined location for ICP/ECC
- backup power supply
- secured access
- communications
- landline (multiple)
- VHF (where applicable)
- UHF (where applicable)
- IT ports (multiple)
- copy of all emergency numbers
- computers / copiers / printers/ faxes
- IMT database (Network and/or flash drive)
- whiteboards
- meeting room suitable for IMT briefings
- multiple rooms for IMT teams
- allocated emergency services and agency area
- site plans (current hard copy)
- incident boards
- food and drinks
- amenities
- CIMS position packs to include
    - Vests Hard
    - copy of EMPCP (Including site TARPS), UG Mines Emergency Protocol
    - CIMS position description
    - Stakeholders contact list
    - IMT contact list

13.2 Incident Action Plan (IAP) Process

At each stage of the planning process, Incident Management Team (IMT) functions need to ensure that the latest information on hazard impacts and available resources is used.

13.2.1 Objectives Analysis

This is the most important step in the planning process; it is when the Mine Incident Controller (MIC) and planning team determine what the action plan is meant to achieve. It consists of the following steps:

Reviewing the situation, confirming:

- the goal and objectives of the plan;
- the resources available, including any resources still to arrive;
- response actions to date;
- initial hazard impacts;
- area of operations for the response, including outside the affected area; and
- Timeline for the response (in terms of the overall operation and the time available for planning), and the time the Action Plan will be completed

13.2.2 Options Development / Strategies

During this step, the planning team develops options that will achieve the objectives. The number of options and detail that is developed depends on the time and personnel available. Ideally, planners consider two or three options, to avoid jumping to a conclusion without having considered alternatives.

The options need to be different from each other, must achieve the response objectives, have acceptable levels of risk, and be feasible with the available resources. Experienced MIC and planners may be able to develop a single option, using their judgment to save time.

All options must be evaluated against the following:

- Impact analysis, the most likely, and the most dangerous/worst case scenarios for hazards to develop;
- Local environment, and how this may affect the response;
- Available resources, their numbers, location, capabilities, and requirements; and
- Available time.

13.2.3 Action Plan Development / Assignments

During this step, the Action Plan is written. If time is short, it may be written as a brief, to be delivered verbally. It must be documented for future reference. Maps and tables may be included to aid understanding. Specialist sections and appendices need to be written by those functions. These allow important specialist information and instructions to be included, without cluttering the main body of the Action Plan.

To aid the reader, who may have limited time and be working in adverse conditions, plans need to be clear, brief, and avoid jargon. Ideally formatting, grammar, and spelling are checked. The MIC approves the final version, and this becomes the official Incident Action Plan (IAP).

In underground level three emergencies this IAP will be sent through to the Local Controller (Police) for review and to keep the LC (Local Controller) up to date with what action is being proposed.

IAP areas to consider:

- according to objective set by MIC
- approved only by MIC
- primary task of Intel / Planning
- consideration of parallel planning (may require subgroups within Intel/planning)
- states strategies
- operational period of the IAP
- assignments and accountabilities
- communication plan
- utilize common IAP templates (CIMS)
- risk assessments attached to all IAPs
- Utilize common RA templates (agreed as industry best practice. Suggested JHA type task orientated and commonality of design)
- Any approved IAP's can only implemented by operations according to that IAP.
- Operations must abide by risk assessment conditions according to approved IAP

13.3 Response Documents

CIMS relies on the use of standardized templates to aid information management, information collation and analysis, planning and decision-making.

ICP areas and Emergency boards have been based on the CIMs model to assist when external agencies are involved so that all parties are using a similar system.

14 TESTING

To make sure that the mine and its workers are ready in the event of an emergency mine operators should:

- Test the plan during the year using simulated emergencies
  - UG crews perform trial evacuations eight times a year.
  - Processing and surface personnel at Baxter Rd perform surface trial evacuations four times a year.

- Open pit and development site trial evacuation once a year each.
  - Moresby Ave offices trial evacuation twice a year.
  - IMT scenario to test the plan to a level 3 incident once a year.
- Conduct investigations after any emergency events.
- Regularly inspect, check, and ensure that all emergency equipment is working including:
  - Alternative breathing equipment
  - Refuge stations and other places of safety
  - Firefighting equipment
  - First aid equipment
  - Any other critical equipment contained in the plan.
- Provide regular maintenance training for mine rescuers at the mine (approx. 12 days per year), and
- Recruit, train and retain sufficient emergency response workers to implement the plan.

The adequacy of the maintenance and inspection programs identified in the Critical Control Check Sheet (CCCS) is ensured by the Document Owner and the SSE conjointly reviewing the CCCS on completion.

15 EMERGENCY RESOURCES

15.1.1 Incident Control Points

This title refers to several different rooms located around the sites that will be used as an Incident Control Room for the duration of an emergency.

These locations must be equipped with the following resources:

- IMT briefcases (including vests and duty cards)
- Incident action plan boards / situation boards
- Current maps
- JHA forms
- Trigger Action Response Plans (electronic version when possible)
- Internet access / Computers
- Phones (including mobile coverage)
- access to extra office facilities

15.1.2 Emergency Response Mines Rescue Station

Equipped with BG4's, SCBA units stored in a cool dry area, Cap lamps, Self-rescuers, Captain's Bags, Gas monitors and Radios.

The Station has stored back up oxygen cylinders, ice candles and soda lime. Full cleaning facilities are available for BG4 refurbishment along with Oxygen and Compressed air refill equipment.

15.1.3 4WD Ambulance

The mine site is equipped with a 4WD ambulance which is located at the Mines Rescue Station. This vehicle is fitted out with all basic ambulance equipment and has been suitably modified for both Underground and Surface emergency response.

The Ambulance carries a stretcher in a lock box on the roof and relevant Stretcher bridles for Vertical Rescue requirements. The stretcher is designed to fit inside the rear of the Ambulance and can be locked in place with a specific purpose fitted restraining belt. It carries a MARS (Manual/Automatic resuscitation System) unit, a full resuscitation bag and an AED.

The 4WD Ambulance also has the capability to carry ten personnel if required, carries 4 x Portable handheld Radios as well as two Base Set Radios (UHF / VHF) for Surface and Underground communications.

The 4WD ambulance is to be used only under the guidance of emergency response personnel and for patients in serious condition being transferred to other emergency services or a Medical Centre.

15.1.4 Rescue Trailers

There are two main MRT trailers set up for emergency situations. The trailers are located at the Mines Rescue Station. These trailers contain enough rescue equipment for the initial response to most emergencies.

15.2 Fire Fighting/Rescue Resource

15.2.1 Fire appliance

Site has a fire appliance permanently located at the Mines Rescue Station that carries all appropriate firefighting equipment including a mobile portable pump for drafting water from alternative water supplies. As the appliance does not have an on-board water supply (tank), site water carts are also fitted with fire-fighting couplings to assist as a resource in an emergency.

There are also multiple adapters and couplings to source water from site in emergency situations.

15.2.2 Extrication Equipment

Extrication equipment will be used when there are incidents requiring removal of anyone that may be trapped or crushed.

The fire appliance carries 3 x 40 tonne high pressure lifting bags, a combination rescue tool (hydraulic pump spreader/cutter) and basic glass management equipment.

There are also battery powered hand tools to compliment these rescue devices. All equipment stored on the appliance is compatible and interchangeable with FENZ equipment.

15.2.3 Surface Fire Hydrants

Surface fire hydrants are in line with FENZ standards and are located in strategic locations on the surface (Appendix R Process Plant Safety Appliance Area Map).

This reticulated water supply is fed by two 37kW pumps located at the discharge manifold of the Compliance Ponds. These pumps also have a manually operated diesel back up pump in the event of a power outage. These hydrants are inspected and serviced under contract by nominated service provider and further maintained via PM schedules.

15.2.4 Deluge System

There is a deluge system in place to protect the two 39,000l LPG bullets located beside the training room. This is activated by opening the LPG flood valve across the yard by the kibble storage area. This system has multiple water sources, in normal operation it runs on the process water line. In the event of a failure on this line the valve work can be reconfigured to run off Fire main water which also has a diesel-powered back-up pump on it.

15.2.5 Underground Fire Fighting Resource

The underground is supplied with gravity fed water from two 30,000l tanks. This water flows through 110mm poly pipe to maintain flow and pressure. It is maintained by the service crew and is located throughout the working areas of the mine. There are strategic locations for the installation of “droppers” on the decline, accesses, and drives. These droppers are spaced appropriately in accordance with mine design plans and are used for both mining and firefighting. In the event that a dropper is not located in a favourable position in an emergency, the use of a “break in” coupling can access water for firefighting at any location beneath the 110mm poly pipe. This coupling is located on the fire appliance.

15.2.6 Hazardous Material Response

The Mines Rescue team is trained and equipped to deal with Hazardous Material emergencies onsite. Level 2 structural firefighting uniform is located on the southern wall on the inside of the Mines Rescue building.

Trailer two, inside the Mines Rescue building, is set up with equipment used to deal with Hazmat response and includes four Level 3 Splash suits, as well as four Level 4 Fully encapsulated Gas tight Suits.

Other equipment in the trailer includes spill control items, wedges, sealants, pads, mops etc. The MRT utilize a coloured decontamination Tarp to further demarcate hot/warm/safe zones.

15.2.7 Fixed Plant Gas Detection

There are 8 fixed plant Cyanide monitors located around the process plant, with 1 Ammonia detector located in the Sag Mill Sump area. For locations of the monitors see Appendix E Fixed Plant Gas Monitors – Process Plant

15.2.8 Fire Extinguishers

Fire Extinguishers are located across site in strategic locations in line with building and evacuation regulations. Fire extinguishers are also located in all vehicles, mobile and heavy plant.

15.2.9 Safety Data Sheets

SDS sheets of all hazardous materials on-site are kept primarily on the web-based database ChemAlert. Secondary copies can be found at the First Aid Room and Mines Rescue Operations Room.

15.2.10 Site Run Off

All site run off within OceanaGold is direct to containment ponds then sent to the water treatment plant. These include Tails Contingency Ponds 1 & 2, Mill contingency ponds, Silt and Collection Ponds.

15.2.11 Family Liaison Facilities

The Waihi Education Building located on Moresby Ave and or the Waihi Baptist Church are both suitable for family liaison, welfare, psychosocial support etc. Extra resources can be arranged through the police liaison officer if required. Local Civil Defence and victim support groups who can provide further manning for these facilities if required. Waihi Mines Rescue has access to the local FENZ area support person if required.

16 EXTERNAL RESOURCES

16.1.1 New Zealand Mine Rescue Service (NZMRS)

NZMRS are available to provide assistance for long duration underground rescue operations. The closest station is located in Huntly, but response is likely from Auckland. Once notified, NZMRS have a response time to Waihi by road of approximately 2 hrs.

16.1.2 Mobilization Procedure for NZ Mines Rescue Service

In the event that Emergency response is required at an event at Waihi Operation, the following number is to be called:

- Huntly Station 07 828 9772 (24hr emergency contact)

16.1.3 Initial response from NZ Mines Rescue Service (Huntly)

- Emergency response personnel will report to the emergency response station ready for deployment.
- The necessary number of teams will be deployed to the mine site and additional teams will remain at the Huntly Station for forward deployment if required.
- In the event of a major incident the Huntly Station will be always manned.
- If an incident warrants it, backup teams/resources are available from Rapahoe located north of Greymouth in the South Island. Mines Rescue has a procedure in place for the deployment of personnel between Rapahoe and Huntly via helicopter and fixed wing aircraft.
- If BG4 breathing apparatus is being used, Emergency response personnel will be based at the Rescue Station to clean and re-commission sets. Sufficient stores are maintained to replenish operational supplies as required. BG4 sets could be cleaned and re-commissioned within 2 hours.
- A senior emergency response member will be part of the incident management team.
- If gas analysis is required, a person trained in the use of the gas chromatograph will be based at the Rescue Station with 24hr expert support available from CMT in Australia.

16.1.4 OGL Macraes Operation Mines Rescue Teams

Located near Dunedin in the South Island Macraes mine has approximately 50 x fully trained emergency response members and could provide assistance for long duration underground rescue operations.

16.1.5 St John Ambulance

St John Ambulance provides emergency medical aid and transport for accident/illness casualties. Initial response usually comes from Waihi located 2.5 kilometres away from the Underground Mine and backup response coming from Paeroa (35km), Thames (60km) or Katikati (40km).

- Contact by phoning - 111

Rescue Helicopter activation is normally a 111-function request from Ambulance.

Westpac operates the rescue helicopter located at Mechanics Bay Auckland. The helicopter takes approximately 30 minutes to reach site and will be dispatched if the incident/illness justifies its use.

16.1.6 Waikato Regional Council

Waikato Regional Council have spill response teams available for environmental events, contact the Council 24/7 on 0800 800 401.

16.1.7 Fire and Emergency New Zealand

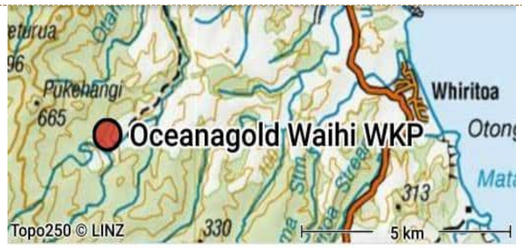
The closest fire station is located in Waihi which is 2.5 kilometres from the Underground mine. Response time is approximately 8 minutes. Fire service assistance for chemical incidents will come from Greerton and will take approximately 1 hour 15 minutes.

16.1.8 Helicopter Air Support

Medical Emergency

In a medical emergency, the 111 operator will dispatch an ambulance to the relevant street address. If the nature of the emergency requires a helicopter, then St. Johns air-desk has the relevant helipads listed on their system. These coordinates will be communicated to the responding rescue aircraft.

<table>
<tr><td>“OCEANAGOLD HELIPAD” – 232 Baxter Rd</td><td>“WKP” – Helipad (North)</td></tr>
<tr><td>S 37°23’35.0” E 175° 52’00.7”</td><td>S 37° 17’39.7” E 175° 49’09.7”</td></tr>
<tr><td>


Oceanagold Helipad
Coordinates
WGS -37.39306 175.86686
WGS S 37°23.583' E 175°52.012'
WGS S 37°23'35.0" E 175°52'00.7"
UTM 60H 399697 5860921
MGRS 60 HUD 99697 60920
NZTM 5857666N 1853791E
</td><td>


Oceanagold Waihi WKP
Coordinates
WGS -37.29437 175.81936
WGS S 37°17.662' E 175°49.161'
WGS S 37°17'39.7" E 175°49'09.7"
UTM 60H 395355 5871818
MGRS 60 HUD 95355 71817
NZTM 5868744N 1849912E
</td></tr>
</table>

NOTE: For a medical event at Waihi North the 111 operator will need to understand the “remoteness” of this site. This will then elevate the requirement for helicopter extraction for a lower-level injury/illness. Other lower-level response options to a medical event at Waihi North include; Skyworks pick up from helipad, or mines rescue team member deployment to scene via Skyworks long line (Human External Cargo - HEC).

If the emergency is time critical, activate PLB and a rescue aircraft will be dispatched to that exact location.

If the emergency does not have St. Johns involvement, then the above helipad coordinates will need to be communicated to the pilot.

Any updates to OGL helipads or coordinates are to be communicated to St. Johns air desk

- **0800-247-3375**

16.1.9 Emergency Co-ordination Centre (ECC)

The ECC will be set up once the Mine Incident Controller has declared a level 3 incident. Its main purpose is to assist the communication process between the mine and external agencies.

The following is how the ECC is determined and set up:

- determined by local police (Waihi Moresby Ave Offices or Waihi Police Station)
- above includes consultation process between mine site and police
- pre-determined location recorded in this PCP
- copy of current site plans and this PCP
- communication between ECC and ICP assured
- activation process is agreed and recorded in this PCP
- Ensure critical activation and implementation advice is logged into Police call centre database (site access point, site security, reporting areas on site, ECC location and resourcing)
- Lead by Local Controller (LC), normally a Senior Police Officer.
- The Underground Mines Emergency Protocol comes into effect when:
    - any stakeholder declares a level 3 event
    - MIC, CIE and police are notified
    - CIE appoints a Registered MIC
    - LC is established
- LC contacts MIC informing that ECC is operational.

16.1.10 Involving External Parties in Emergency Exercises

It is essential to work in with external parties when conducting exercises or response training onsite. This will build relationships and check for knowledge and understanding of OceanaGold emergency processes.

Mine rescue conducts inter agency training on an annual basis with:

-

- NZ Police
- FENZ
- St. Johns
- NZMRS

Evidence of this is held with the Emergency Response Coordinator.

16.1.11 Underground Mines Emergency Protocol – Police Actions

This action plan has been developed from the NZ Police and what they do once a level three incident has been declared.

The following action points must be taken (these are not necessarily in a priority order).

Table 5: UG Mines Emergency Protocol – Police Actions

Underground Mines Emergency Protocol – Police Actions	
16.1.11.1 Police Liaison Officer	
	Dispatch a Police Liaison Officer and at least one other Police staff member with their mobility devices to the mine. The Police Liaison Officer will be a person trained in CIMS (minimum) and will have completed the SAR Managers course. Task the Police Liaison Officer and other staff member to communicate the initial response Incident Action Plan (IAP) and any subsequent IAP to Hamilton District Police Headquarters as soon as possible (this may include photographing the IAP and driving to cell coverage, e-mail the photo).
16.1.11.2 Perimeter Control	
	Establish perimeter control at the gate. The mine company indicates it will allocate staff to gate security, however a police presence may be required, even if only initially.
16.1.11.3 Communication	
	Establish communication with the mine and the Mines Incident Controller. If the operation is to be an extended one, consider obtaining Vodafone enhancement of the cell net if necessary.
16.1.11.4 Police Forward Controller	
	Appoint a Police Forward Controller to manage all Police functions (including support and staff to the perimeter control and mine). The Police Incident Controller will be based at Waihi Mine. As a priority, the Police Incident Controller will dispatch staff to the Waihi Gold Education centre - establish family liaison, including communicating with families that this is the meeting point, and arranging welfare and psychosocial support for families. This will include activating the local CD Welfare Plan.

Underground Mines Emergency Protocol – Police Actions	
16.1.11.5 Advise District Commander	
	Advise the District Commander via the District Command Centre and provide SitReps. The District Commander will assume the role of Emergency Coordinator.
16.1.11.6 Emergency Coordination Centre/Local Controller	
	Establish Emergency Coordination Centre/Local Controller (LC) at the Waihi Gold Moresby Ave offices (Royal Room). This will require a 2IC, Planning/Intel and Logistics Officers. They will receive the initial response IAP, arrange any support required by the Mines Incident Controller and (prepare to) brief the Emergency Coordinator. Keep the District Commander briefed.
16.1.11.7 Activate Ambulance	
	Confirm activation of Ambulance and advise DHB of likely incoming injured. Dispatch liaison and security to the hospital as required.
16.1.11.8 Activate National Disaster Victim Identification (DVI) Plan	
	Advise Police National Headquarters; National Command Control Centre; request the National DVI plan to be activated.

16.1.12 Additional Resources

Include but are not limited to:

- software for geotechnical analysis, design, and planning
- specialist contractors and service providers
- equipment – from overseas
- associated controlled documents

16.1.13 Dealing with the Media

The only personnel authorized to talk to the media on any issue is:

- The General Manager
- And/or his authorized nominated representatives
- Any contact or request from Media to any other staff member on any issue should be answered as follows: “I am not authorized to comment”.

16.1.14 Police Media Relations

Any requests from the media for information regarding a mine's emergency are to be directed to the LC at the ECC or to the Hamilton Police District Media Liaison Officer.

16.1.15 Public Information Management (PIM)

Public Information Management (PIM) is responsible for informing the public about the incident and the response (including actions they need to take), media liaison and monitoring, and community liaison. On the Mine Incident Controller's direction PIM also issue warnings and advisories. (Usually, NZ police will fill this role)

The lead agency has responsibility for developing key messages and coordinating with other agencies' PIM personnel to ensure consistency. A multi-agency PIM group may be required to manage PIM during a response.

17 TRAINING

17.1 Mines Rescue Team Emergency Response Personnel

Training for first response personnel (MRT Members) will be conducted in accordance with the annual MRT Training plan approved by the HST Manager.

Training for Incident Management Team members shall be on at least an annual basis and include a full desktop scenario.

Training for Crisis Management Team members will be as per OceanaGold corporate requirements.

The Mines Rescue Team comprises up to 30 personnel selected from both Underground and Surface Production and other site departments. Mines Rescue Team numbers are maintained to ensure adequate emergency response coverage 24/7.

Each qualified team member can be notified and called to site by way of an SMS (eTXT) initiated by the gatehouse or the Emergency Response Coordinator.

Training records for Mines Rescue Team Members are held with the Emergency Response Coordinator and INX Intuition.

Table 6: Training Requirements

Trainee	Training Requirement
All Mine Workers	All OceanaGold personnel shall receive required site-specific skill and knowledge during mandatory induction training, refresher training, and ongoing job safety training as per the Waihi site training plan. Familiar with our sites Emergency Management process. Additional training will be conducted whenever significant changes are made to the Management Plan All persons affected by the requirements of this plan shall understand the plan and their roles and responsibilities
Supervisors	All of the above All UG production supervisor will be required to be qualified (as a minimum) as a B Grade quarry / tunnel manager, hold a certificate of competence (which includes Level 4 CIMS) and have an appointment letter from WorkSafe.
Incident Management Team (IMT) members – may consist of, superintendents, and technical service personnel	Emergency management training CIMS 2, 4 Desk top emergency scenario training
Mine Incident Controllers (MIC)	Level 4 CIMS
Emergency Response Team Members (Mines Rescue Team)	Team members are trained and qualified in the following disciplines: Full medical upon joining, and annual 12-month health assessment Fitness test – minimum requirement for full operational MRT members BG4 and SCBA breathing apparatus training Rope rescue Confined Space rescue PHEC Medics Lifting bag operations Vehicle extraction Underground search and rescue Underground fire Surface fire HAZMAT response

Trainee	Training Requirement
	Helicopter longline extraction Remote Bush rescue Level 4 CIMS for nominated personnel

18 INCIDENT TEAM CONTACTS

A list of Incident Team contacts will be held in each of the Incident Management Role Profile Packs and the IMT Briefcases. These will be reviewed and maintained on a regular basis (refer contact list in appendices).

19 EXTERNAL CONTACTS

19.1 Emergency Services

A list of stakeholder contact details will be held in each of the Incident Management Role Profile Packs and the IMT briefcases. These will be reviewed and maintained on an annual basis.

20 RESPONSIBILITIES AND ACCOUNTABILITIES

Table 7: CIMS Roles and Responsibilities

Role	Responsibility
SSE	• SSE may also be the Mine Incident Controller as per role and accountability below. • If the incident/emergency has an approved Mine Incident Controller (MIC) in place the SSE role becomes a main support role • Liaise with OGL corporate personnel • Potentially be a backup MIC • Delegate resources as required

Role	• **Responsibility**
Mine Incident Controller (MIC)	• For L3 UG Emergencies, this will be from the Work safe appointed list of approved MIC's • Delegates tasking (Managers) in IMT utilising ideal span of control for team members. • Leads initial briefing of type, time, and magnitude of event as a general summary. Also outline the consequences of that event to date and any actions thus far. • Allocates any site-specific Duty Cards according to EMPCP if not done • Ensures emergency services and agencies are pre-allocated areas according to EMPCP and that they are briefed on arrival. (Delegated tasking) • Responsible for setting objectives (rescue / recovery) • Leads IMT in decision making ensuring all decisions are consultative and collaborative • Calls SitReps as required to maintain situational awareness. (Managers and specialist advisors only attend as required or requested) • Signs off Incident Action Plan (IAP) and Risk Assessment (RA) - only authority to do this under legislation. • Communicates officially with Local Controller (LC) • SitReps (regular scheduled or called for by emergency dynamic to ensure IMT situational awareness at all times. May influence objective, strategy, tactics therefore intel/ planning, logistics and operations) • Higher level resourcing requests to support IAP and / or IMT function • IAP and RA • Anticipates relief manning and staggered change over with appropriate briefings • Ensure consultative process in IAP build • Downgrades to level 2 when appropriate

Role	• **Responsibility**
Planning	• Appoint, brief and task planning team. • Prepare Incident Action Plan. • Maintain maps and display boards. • Track incident and resources status. • Liaise with technical experts. • Conduct planning meetings. • Record decisions, actions, and other activities. • developing long-term plans and contingency plans, • Appoint a person responsible for recovery, • Assisting with planning the transition to recovery, • Convening and conducting planning meetings, and • Forecasting medium-to-long term resourcing requirements that will need to be provided by logistics and supporting agencies.
Operations	• Appoint brief and task Operations team • Implement tactics for the Incident Action Plan. • Manage and supervise operations at the incident. • Establish staging areas. • Assemble and deploy resources. • Provide regular situation status reports. • Review resource needs. • Record decisions, actions, and other activities. • Coordinating day-to-day response activities on behalf of the Controller, • Contributing to the development of the Action Plan, • Implementing the Action Plan, making minor amendments required • Planning response tasks in detail, • Forecasting resource use or needs to Logistics, • Recommending to the Mine Incident Controller which resources are critical, • Keeping the Controller and IMT informed about the response, • Resolving minor conflicts between response agencies.

Role	• **Responsibility**
Logistics	• Appoint brief and task Logistics team. • Help prepare the Incident Action Plan. • Prepare the communications plan. • Ensure incident control room is sufficiently stocked. • Organise resources – RT's, telephones, binoculars, first aid equipment, vehicles, and catering needs. • Process requests for additional resources. • Advise Operations of resource availability. • Record decisions, actions, and other activities.
Intelligence	• Receiving authorised resource requests, and procuring the resources, • Requesting, receiving, storing, maintaining, and issuing procured resources, • Participating in the development of the action plan, • Tracking resource use and financial expenditure, • Activating and operating any required assembly areas, • Providing transport, • Establishing and maintaining information technology networks, • Providing record-keeping and administration support, • Collating and matching offers of assistance, and • Advising the controller and the IMT of logistics issues and resource levels.
Emergency Response Coordinator	• Confirm requirement (or not) for external emergency services. • Confirm requirement (or not) for full MRT activation. • Coordinate with Mine Incident Controller and organise an MRT response to the situation. • Assess further requirements as more information is received. • Liaise with Operations and formulate response plans to the emergency. • Communicate these plans to the MRT Captain.

Role	• **Responsibility**
Public Information Management PIM	• Preparing and sharing information directly to the public (via social media, public meetings, pamphlets etc.), or via the media. Note that the content of official information such as warnings is generated by official processes, and approved by the Controller, • Monitoring the public and media reactions and passing information to the relevant CIMS functions, • Coordinating with other response agencies' PIM activities, • Public Preparing spokespeople for interviews and media conferences (see below) • Liaising with the community, • Working with the media, including arrangements for media visits and media conferences, • Liaising with VIPs and their personnel about site visits, • Ensuring call centres, helplines and reception personnel have current public information and key messages, • Participating in the development of the action plan, and • Advising the Controller on PIM issues.
Welfare	• Welfare is responsible for managing the consequences of an incident on individuals, families/whānau, and communities. The Welfare Manager also advises on the Welfare resources, organisational structure, and facilities

Table 8: IMT Support Roles

Role	Responsibility
HST Manager	• Monitor safety conditions and hazards. • Report directly to Mine Incident Controller. • Establish communications with required personnel. • Notify Mine Incident Controller of potential issues. • Record decisions, actions, and other activities.
P & C Manager	• Liaise with incident controller on employee and family updates • Liaise with contact within the Emergency Coordination Centre (ECC) and pass information as required • Ensure all employee records and details are available
Scribe	• Person designated to keep situation boards and times up to date
Person Discovering Emergency Situation	• Ensure scene safety and assist if able. • Make a quick assessment of emergency. • Phone or RT call to Security.
Emergency Call Taker - Security	• Select the appropriate Emergency Procedure Duty Card guide and follow the prompts
Supervisor	• Evaluate available information and organise a response protecting Life, Environment, Property and Production, in that order. • Liaise with the Emergency Response Coordinator regarding response. • Site/scene security. • Notification to senior management.

Role	Responsibility
Mines Rescue Team Captain	• Follow directions given by the Emergency Response Coordinator. • Direct the Mines Rescue Team • Pass relevant information back to the Emergency Response Coordinator • Emergency Response Structure
All Mine Workers Including Contractors	• Ensure their own safety and others in immediate area • Assist if safe to do so • Maintain radio silence

21 RECORDS AND DOCUMENTATION

OceanaGold uses the on-line safety management system and software INX to record and store safety, health, hygiene, and training requirements. Records are stored securely and indefinitely within this facility. The following suites are specific to the type of data stored and managed:

- InControl – Event and incident reporting, action tracking, audits, inspections, task observations, Mine Record Entries and Management of Change
- InTuition – Worker's training and competency requirements
- InHealth – Worker health monitoring and occupational hygiene monitoring programs.

All inspection and maintenance records are to be held by the relevant department or through Corporate maintenance databases i.e., Pronto.

This document is a controlled document secured within the OceanaGold document control system Team Binder and published to the site through SharePoint.

Any changes made to this document must be documented in the revision reference.

22 AUDIT AND REVIEW

This plan shall be reviewed every 2 years as a minimum and/or in any of the following circumstances:

- Following any event or investigation that impacts on this plan
- Any amendments to the site risk register
- Any amendments to legislation

The SSE must organize for an external audit to be conducted at least once every three years from the date this document is approved by the SSE. The external audit should be carried out by a competent person who is independent of the mining operation. Details of the above audits should be retained for twelve months from the date at which the mining operation is abandoned.

Reference

WAI-300-PLN-011 Internal and External Audits

23 DEFINITIONS

Term	Definition
Action Plan	A document that describes how the response will be managed and how response agencies will integrate their activities to achieve the response objectives. It is owned by the Controller and developed by Planning with participation of all the functions and agencies activated.
Agency	This refers to: • government agencies, including public service departments, non-public service departments, crown entities, and offices of Parliament • local government bodies • non-governmental organizations • Lifeline utilities.
CIMS	See Coordinated Incident Management System
Debrief	A critical examination of an operation done to evaluate actions for documentation and future improvements.
EMCP	Emergency Action Control Plan

Term	Definition
an Emergency	• is an unexpected event or series of circumstances that may endanger the health and safety of people and/or impact on the environment, community and/or cause damage or loss of equipment and production. An emergency requires immediate actions to be taken to minimize adverse effects.
Emergency Coordination Centre (ECC)	A regional level CC that coordinates the regional response and provides support to local level responses.
Emergency Operations Centre (EOC)	A local level CC that coordinates the local response and provides support to incident level response activities
Event	Realization of a hazard
External Audit	An audit in which the lead auditor, at the least, has no constant operational ties to the mine
Haul Road	A purpose-built road designed and constructed to carry heavy loads
Hazard	A source or a situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment, or a combination of these
Heavy Mobile Equipment	Those vehicles used in the process of moving ground material or overburden and/or the construction and maintenance of mine infrastructure. example haul trucks, loaders, graders, water trucks, dozers, front-end loaders etc
ICP	See Incident Control Point. Pronounced I-C-P.
ICT	see Information Communications Technology
Impact Analysis	An analysis of the hazards and environment, that aims to determine the most likely and the most dangerous scenarios for the hazard(s) to progress. These are critical in forming a proactive Action Plan and response.

Term	Definition
IMT	See Incident Management Team. Pronounced I-M-T.
Incident	(1) An occurrence that needs a response from one or more agencies. It may or may not be an emergency. (2) The first official level of agency response (see 'incident level response').
Incident Action Plan (IAP)	See Incident Action Plan
Incident Control Point (ICP)	Single location where an Incident Controller and members of their IMT coordinate and manage response operations at an incident level response.
Incident Level Response	The first official level of agency response, carried out by first responders. Response personnel conduct physical actions such as clearing obstructed roads, treating casualties, fighting fires, conducting rescues, and delivering welfare services. They are supported and/or coordinated by the higher response levels.
Incident Management Team (IMT)	The group of incident management personnel that supports the Controller. Includes the Controller, the managers of Planning, Intelligence, Operations, Logistics, PIM and Welfare; it also may include a Response Manager, risk advisors, and technical experts.
Internal Audit	An audit conducted by the mine personnel
Intersections	Junctions where two or more roadways cross. Light vehicle roads are generally designed and constructed to cross haul roads at 90 degrees
Jurisdiction	An organizations or agency's area of responsibility.
Lead Agency	The agency with the mandate to manage a particular incident. It may have this mandate through legislation,

Term	Definition
	protocols, or agreement, or because it has the expertise and experience in managing a particular hazard.
Liaison	A means of establishing personal communication between response agencies. Liaison Officers may attend the CC occasionally (External Liaison) or be present full-time (Attached Liaison).
Light Vehicles	These are vehicles used for the transportation of persons or minor logistical items. Personnel carriers and service and maintenance vehicles are also covered by this definition
Logistics	The function that supports a response through the provision of resources which help maintain the response plan and the affected communities.
Maintenance Equipment	Includes but not limited to: Light or Heavy Vehicles, Tractors, IT machines, Cranes, Forklift, Skid steer Loaders, Power, and Hand tools.
Management of Change	The process used to assess and assimilate all internally and externally driven changes in a routine but methodical fashion
Manager	The mine operator of a mining operation must appoint a person to: (a) manage the mining operation; and (b) supervise the health and safety aspects of the mining operation every day on which any mine worker is at work
Mine Operator	In respect of a mining operation carried out under a permit granted under the Crown Minerals Act 1991, the person appointed by the permit operator to manage and control the mining operation
Mine Worker	A person who works in a mining operation, either as an employee or as a self-employed person or contractor

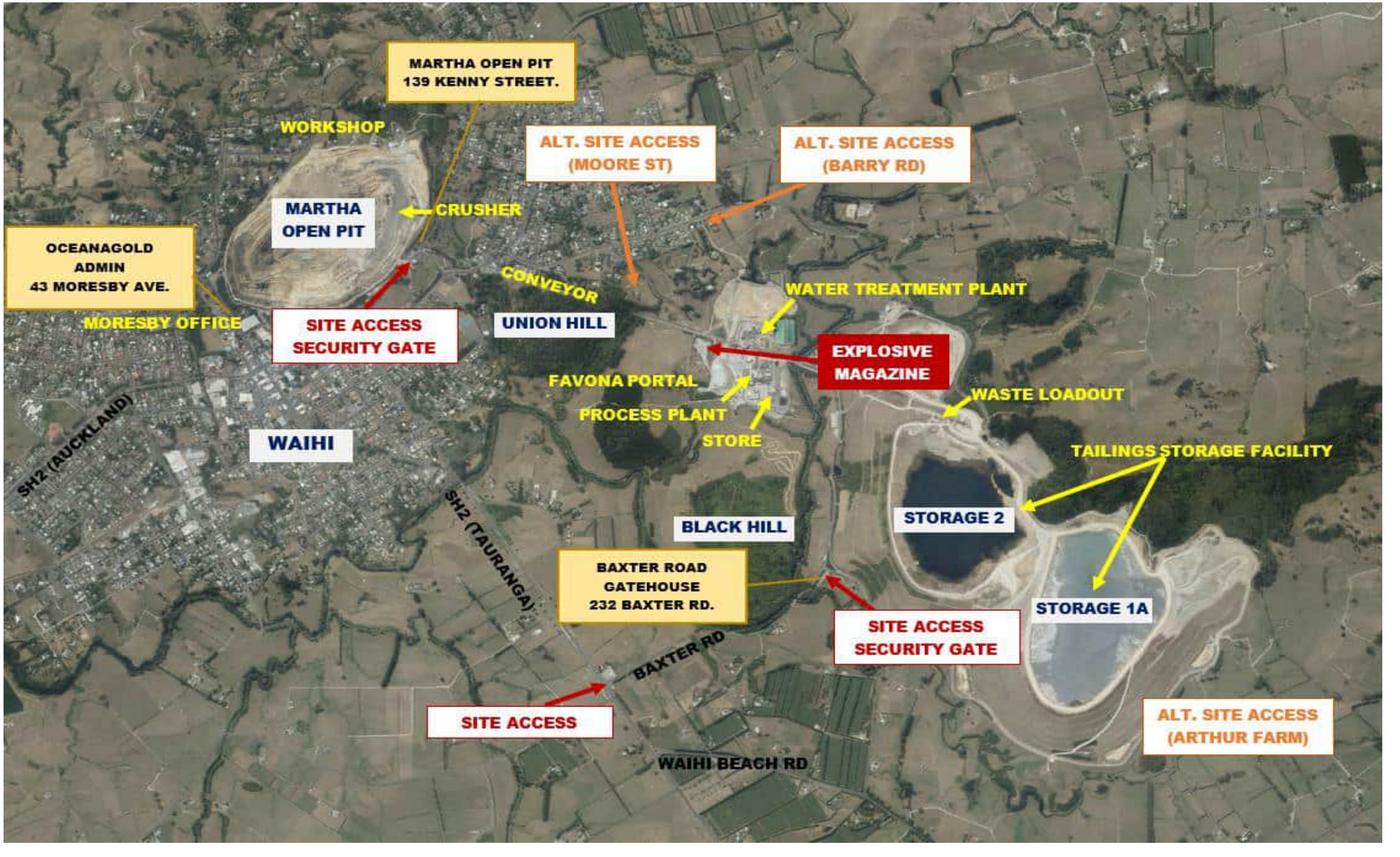
Term	Definition
Mobilization	The processes of procuring or activating, assembling and transporting resources to an incident.
National Coordination Centre (NCC)	A national level CC that coordinates an agency's national response and provides support to regional offices responding to an incident.
National Crisis Management Centre (NCMC)	A permanent, generic national coordination facility for use by any national lead agency. It is intended to coordinate all-of-government responses.
Objective	A statement of what is to be achieved; best described as Specific, Measurable, Achievable, Relevant, and Time-bound (SMART).
OceanaGold	Oceana Gold (New Zealand) Limited
Operations	The function responsible for the coordination of the response, detailed task planning, and the implementation of the Action Plan. It is also responsible for coordinating volunteers and liaising with other agencies.
PCP	Principal Control Plan
PHMP	Principal Hazard Management
Planning	The function that prepares and updates Action Plans, and other plans such as long-term or contingency plans.
Principal Hazard	Any hazard that may have the potential to cause multiple fatalities
Public Information Management (PIM)	The function that, during an incident, prepares, distributes, and monitors information to and from the media and the public.
Readiness	One of the '4 Rs' of emergency management. Readiness means developing operational systems and capabilities before an emergency happens, including self-help and

Term	Definition
	response programs for the general public, and specific programs for emergency services, lifeline utilities, and other agencies.
Resources	All personnel, supplies, facilities, and equipment available, or potentially available, for assignment to incidents.
Response	One of the ‘4 Rs’ of emergency management. Response means actions taken immediately before, during, or directly after an emergency to save or protect lives and property, and to bring the consequences of the emergency to a point of stability that allows Recovery to take over.
Recovery Manager	To develop recovery plans to include the identification, coordination and management of long and short-term goals and the resources required for them to be achieved.
Risk	The chance of something happening that will have an impact upon objectives. Risk is measured in terms of a combination of the consequences of an event and their likelihood. Risk may have a positive or negative impact.
Risk Management	The culture, processes and structures that are directed towards realizing potential opportunities whilst managing adverse effects
Roadblock	A barrier or obstruction preventing or limiting the passage of vehicles.
Situation Report (SitReps)	A brief description of an incident, usually given at regular intervals.
Situational Awareness	An understanding and appreciation of the complexities of an incident including an understanding of the environment, the situation, likely developments, and implications

Term	Definition
SSE	Site Senior Executive
Technical Expert	An adviser with specialist skills or knowledge that is needed to support incident operations.
Triage	A process for sorting patients according to severity of condition. Forward triage is a rapid assessment completed inside the inner cordon; it is followed by secondary triage which generally occurs in the casualty clearing area. Triage status usually determines the order and speed in which patients are taken to the treatment area and also helps priorities where and when patients will be taken to more definitive care.
Trigger Action Response Plans (TARPs) and Emergency Action Plans (EAPs)	Trigger points that necessitate specific actions to be taken in an emergency event. The aforementioned plans shall be authorized by the Safety Manager and subject to approval by the SSE
Windrow	A continuous mound of loose material, of appropriate height, placed at the toe or crest of a slope as a barricade to falling objects or to prevent personnel/mine equipment from falling inadvertently down pit walls. Can also be referred to as a bund.

24 APPENDIX

24.1 24.1 Appendix A Site Layout Plan & Alternative Access Points



24.2 Appendix B Muster Point – Open Pit

24.3 Appendix C Muster Point – Treatment Plant / Underground

Area	Area Description	Check for Personnel	Muster Point #
Area 1	Gold Room	• Gold Room • Office/MCC • Elution Building • Reagent area • Electrolyte and Cyanide mixing area • Processing Training Office	North
Area 2	Training	• Health, Safety & Training Offices • LPG Area • Lime Silo at CV8	North
Area 3	WTP – including Batch Plant	• Reagent areas • Control room and tanks • Ponds • RO Plant • Polishing Pond Stockpile	North
Area 4	Transfer Station	• Hut • Transfer station • CV2 from tunnel to transfer • CV8 from tunnel to bridge	North
Area 5	Stores	• All storage bays • All office areas • Stores Yard	South
Area 6	Processing Workshops /Offices	• All offices • Engineering workshop • MCC Shed • Blower Shed	South
Area 7	Thickener & Conveyor 5	• Thickener • CV5 conveyor area • Scats Tower • Reclaim Hopper	South
Area 8	SAG Mill & Ball Mill Tanks	• All Floors of SAG & Ball Mills • Tanks and tails • Tank 1A Operator hut	South
Area 9	UG Amenities	• Amenities Building • Offices	South
Area 10	UG Workshops & Core Shed	• UG mechanical workshops • UG wash bay • Core shed • Storage containers	South
Area 11	Development Site Offices	• Offices • Workshop/storage area	East

24.4 Appendix D Muster Point – Development / Waste Disposal Site

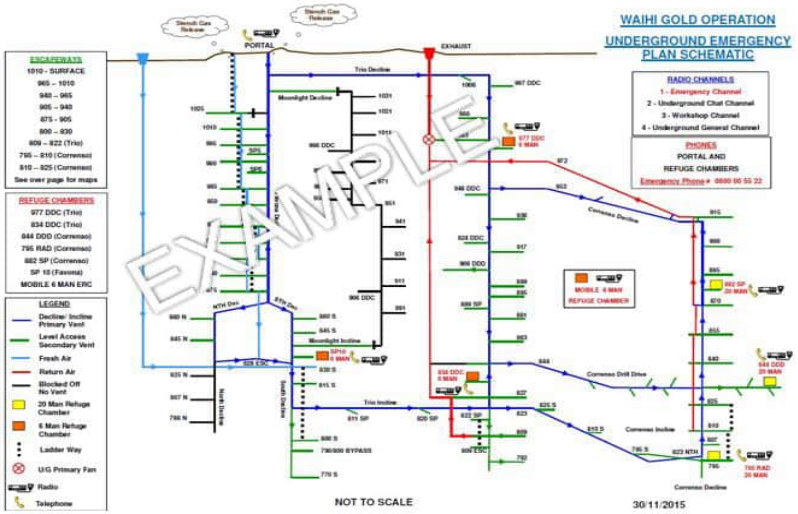
24.5 Appendix E Fixed Plant Gas Monitors – Process Plant

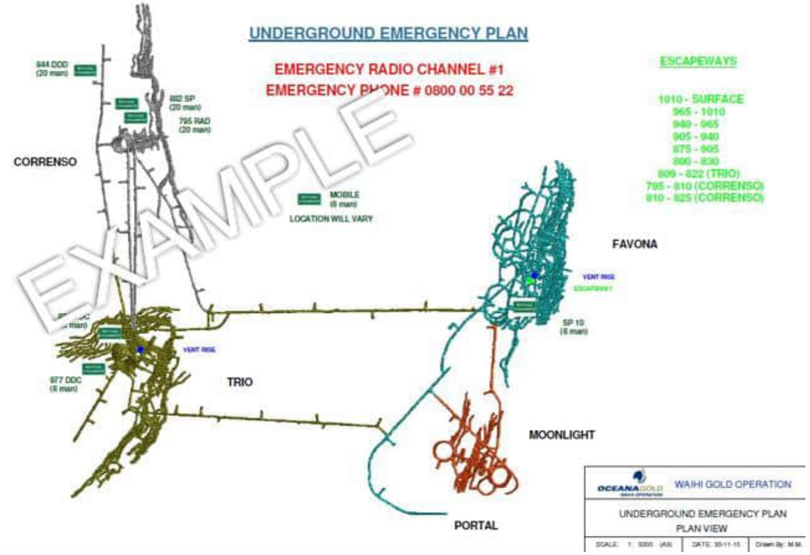
Fixed Plant Cyanide Monitor

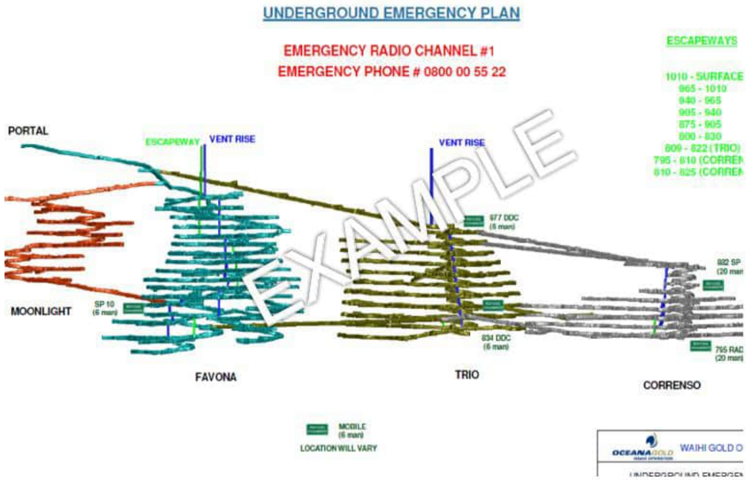
Fixed Plant Ammonia Monitor

24.6 Appendix F Underground Emergency Plan Maps

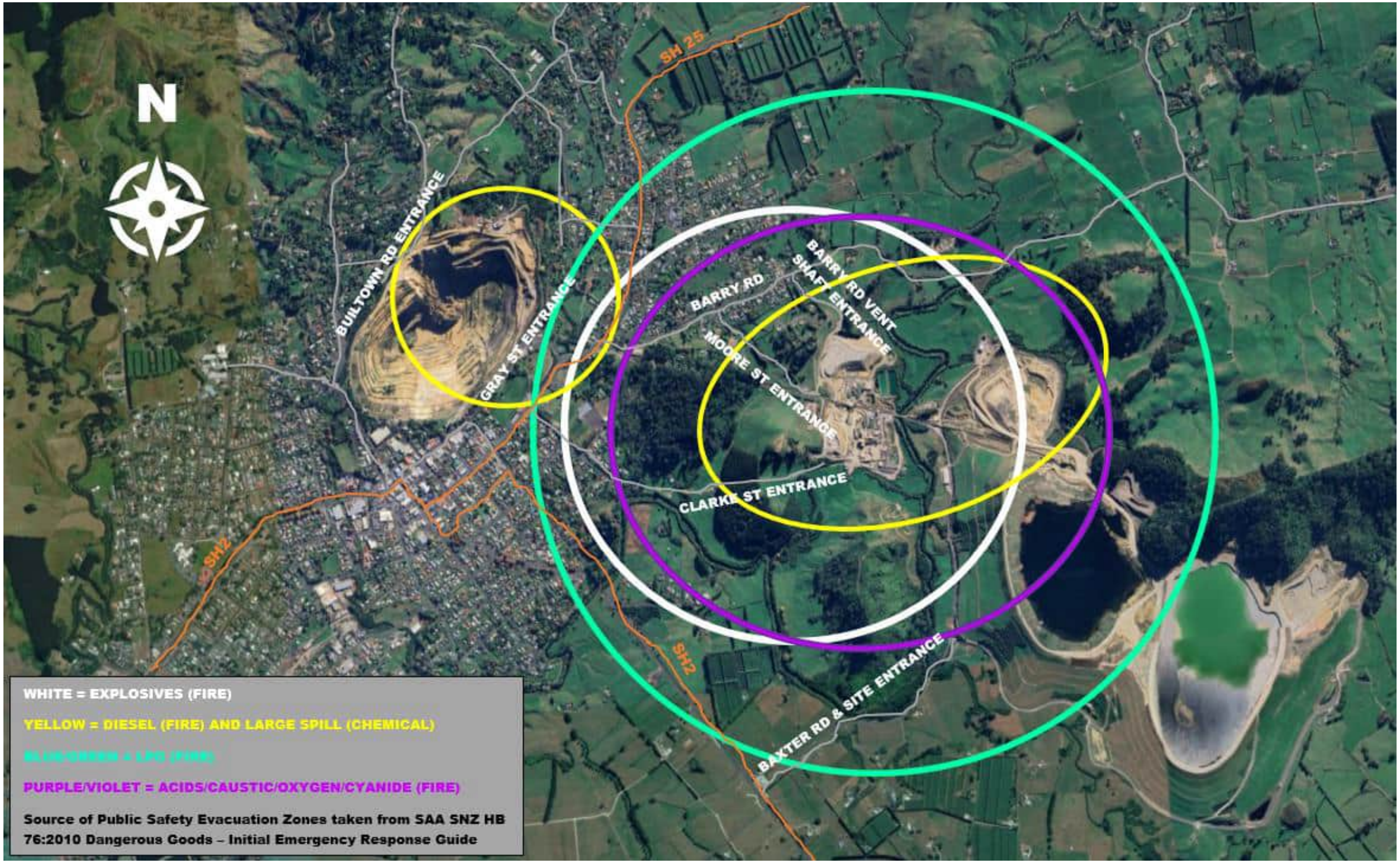
Note: Current copies are held in the Crisis Management Briefcases, Mines Rescue Team, SharePoint



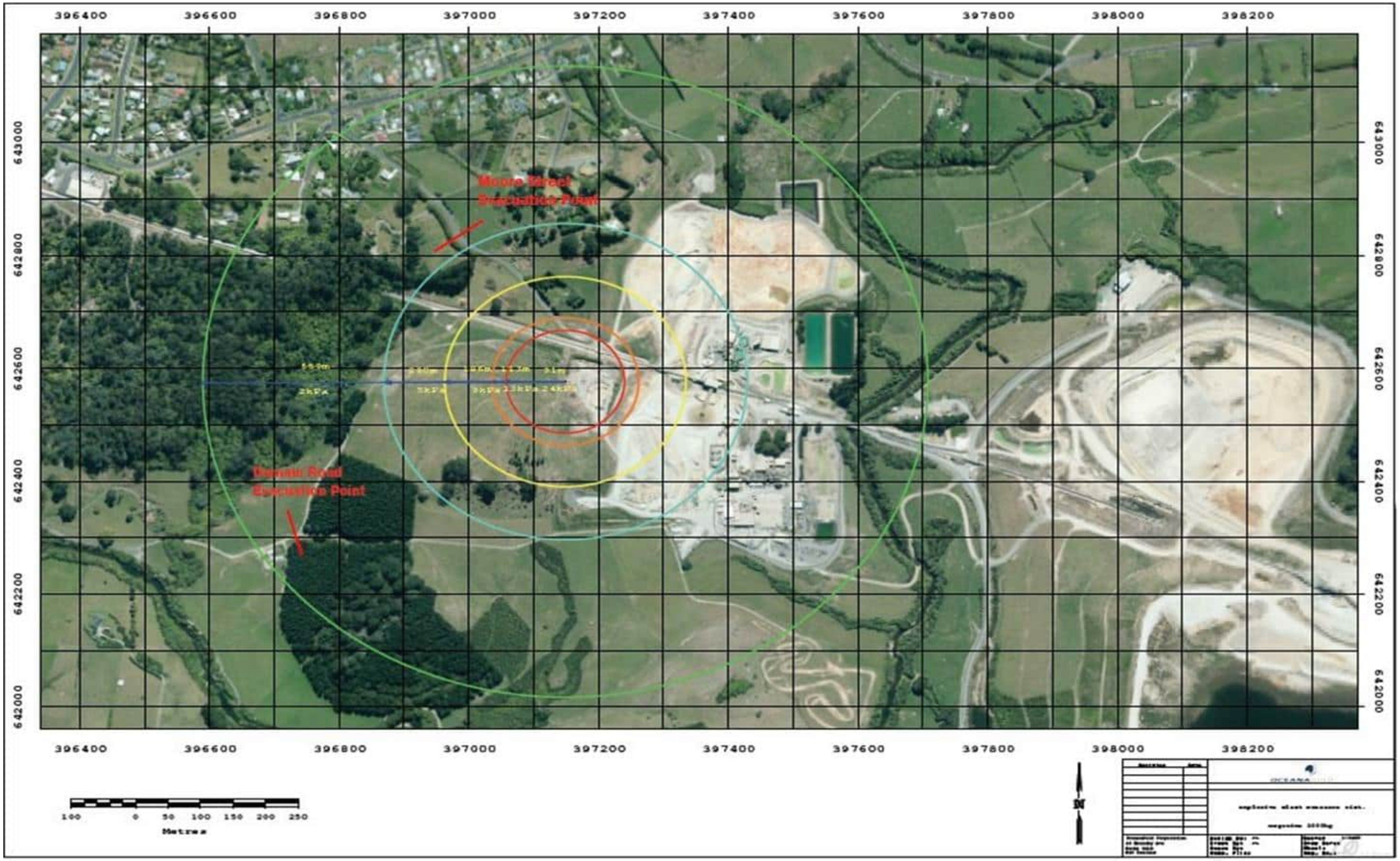




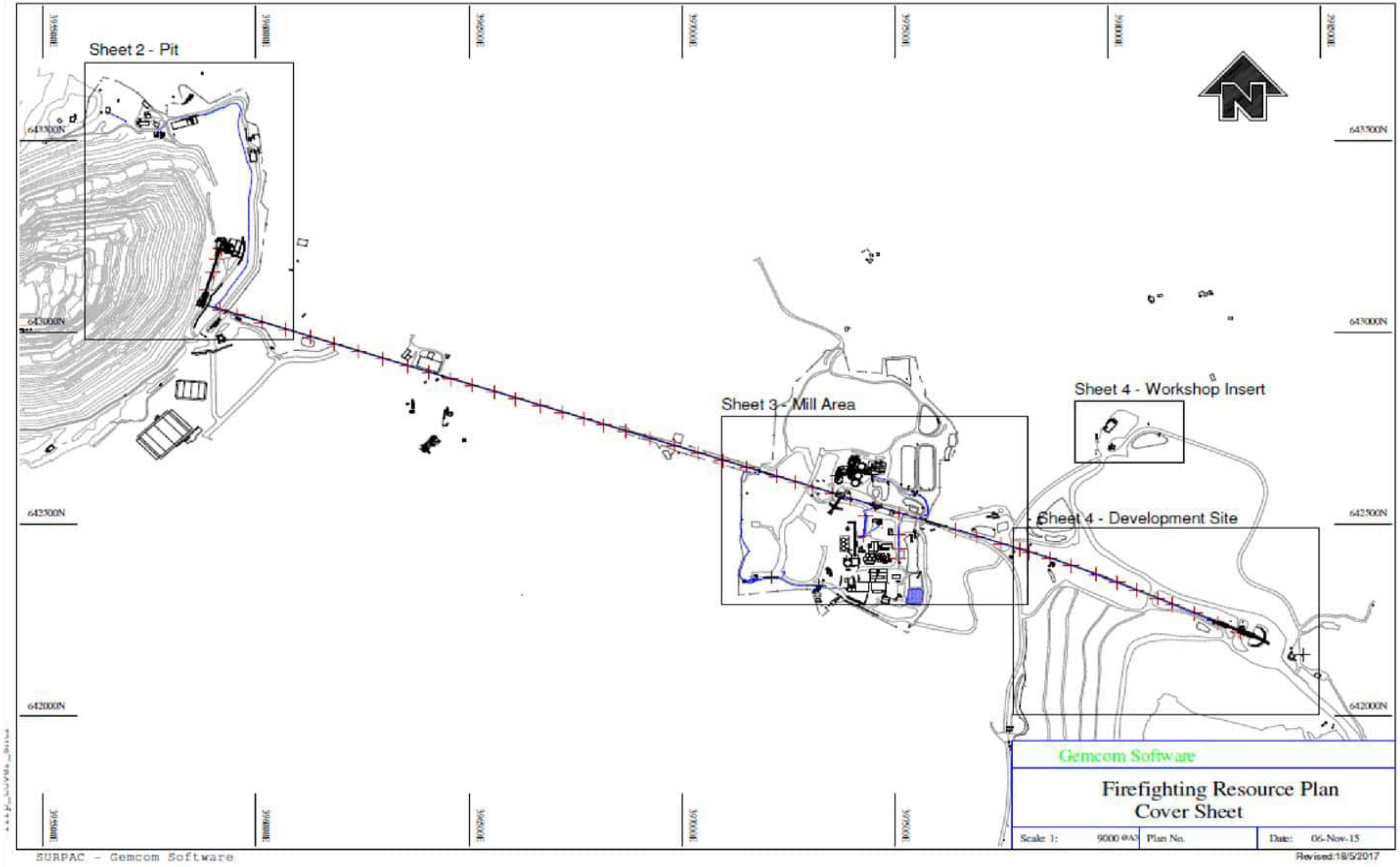
24.7 Appendix G Public Safety Evacuation Zones



24.8 Appendix H Explosive Blast Pressure Distance



24.9 Appendix I Fire Fighting Resource Maps



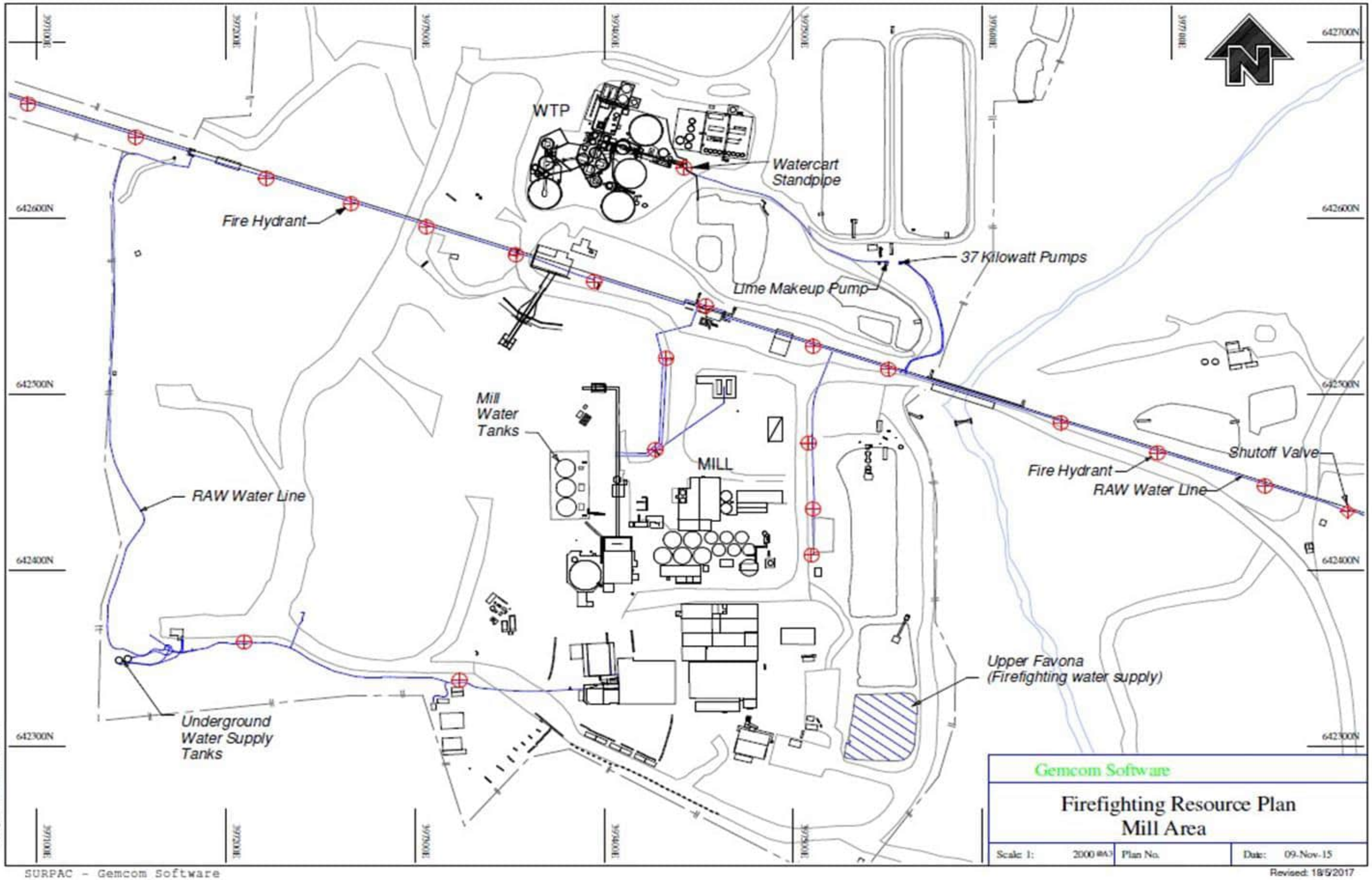


Figure 4: Processing Plant

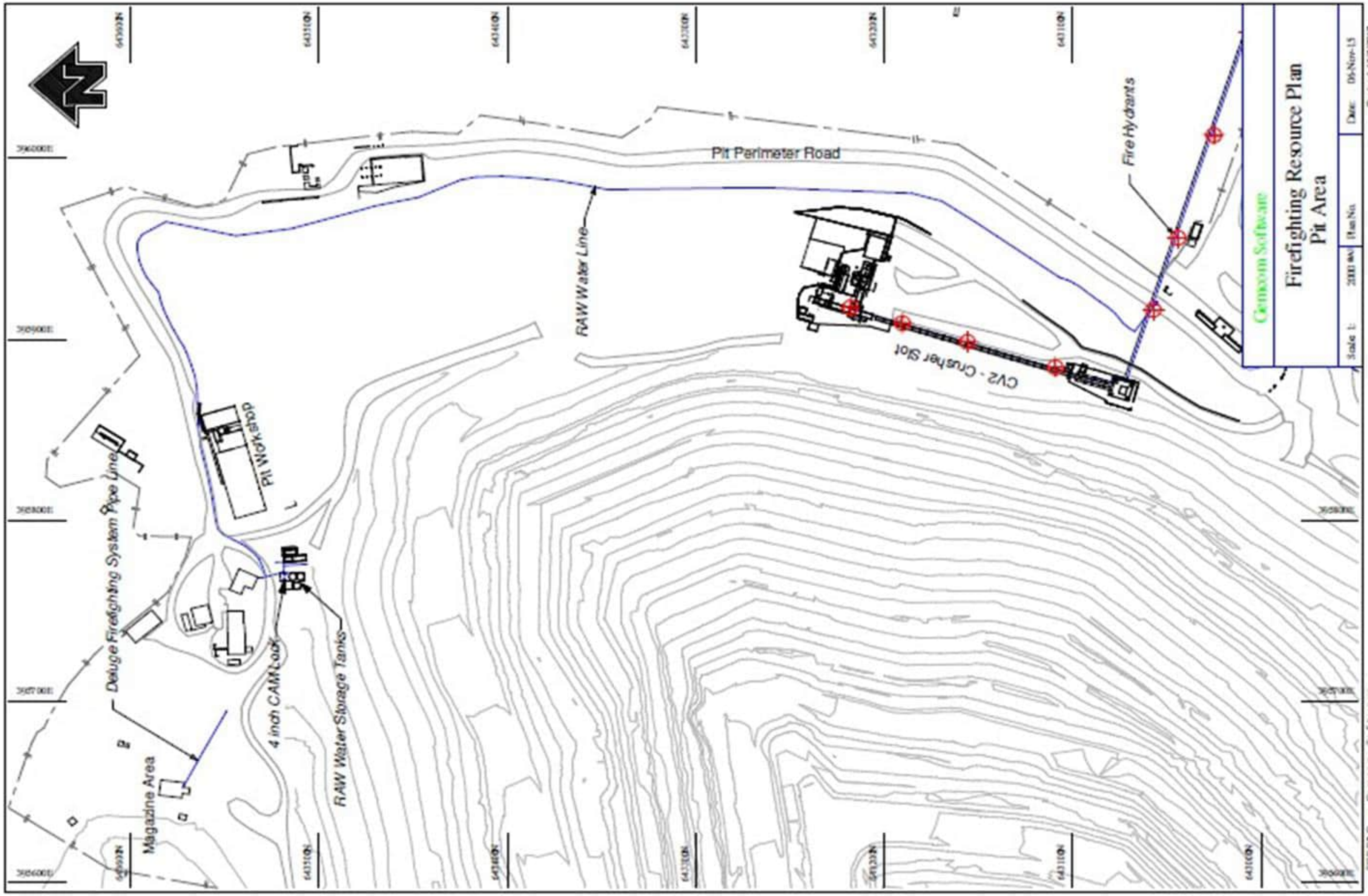


Figure 5: Open Pit

Approver: SSE/General Manager　　Approved date: 05/10/2023　　Next Review: 05/10/2025

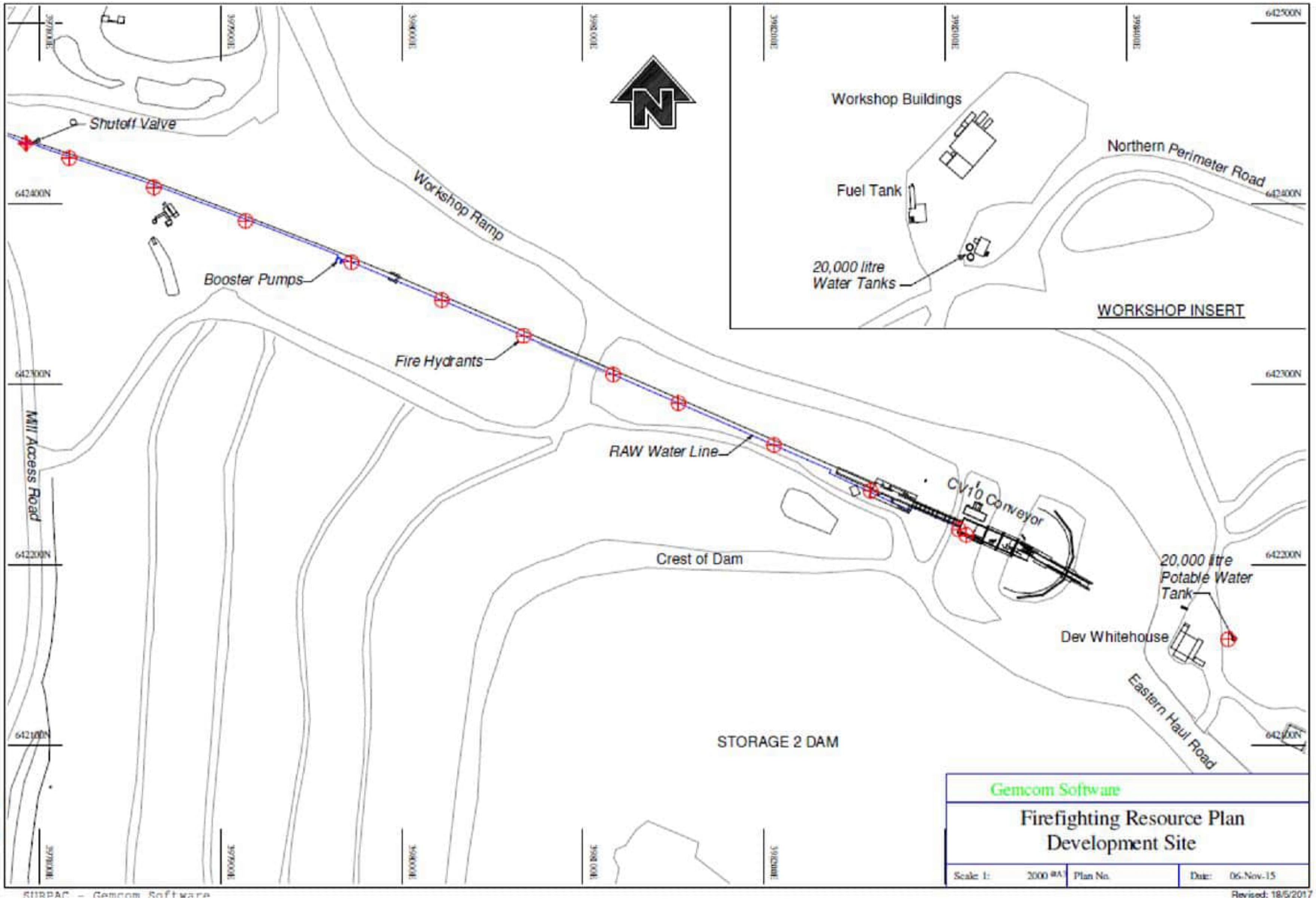
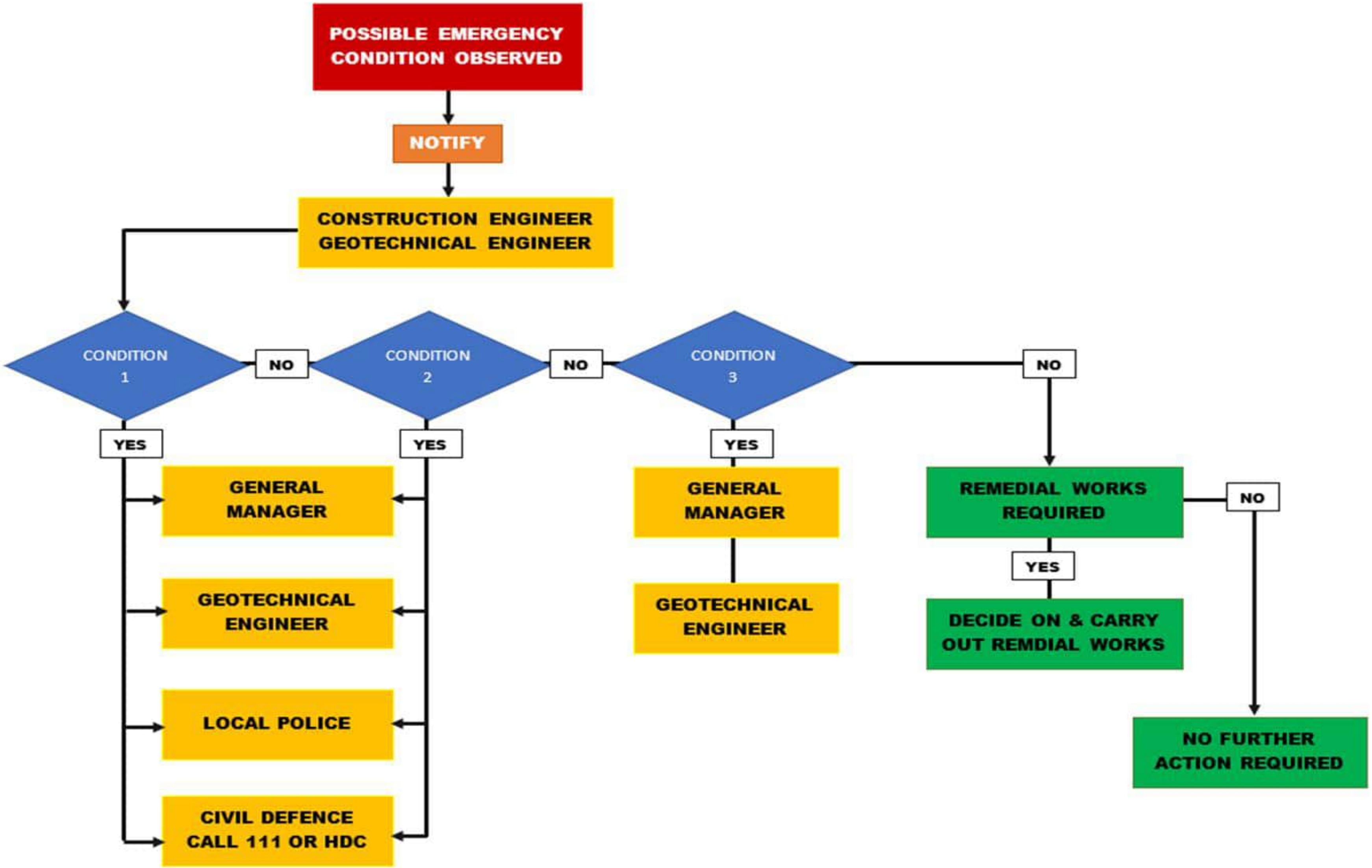


Figure 6: Development Site

24.10 Appendix J Dam Embankment Notification Flow Chart (Check contact numbers)



24.11 Appendix K Classification of Dam Embankment Visible Features

Approximate Decreasing Severity

POSSIBLE LOCATION						
FEATURE OBSERVED	POND	DAM EMBANKMENT	ABUTMENT	TOE AREA	NATURAL SURFACE DOWNHILL OF EMBANKMENT	BEHIND POND OR EMBANKMENT
Whirlpool	🔴					
Spring (new) with high flows >10 l/sec		🔴	🔴	🔴	🟠	🟢
Existing spring large increase in flow		🔴	🔴 🟠	🔴 🟠	🟢	🟢
New landslide		🔴	🔴	🔴 🟠	🟠	🟠
New landslide Scarp		🔴	🟠	🟠	🟢	🟢
Crack		🔴	🟠	🟠	🟢	🟢
Bulge or Heave		🔴	🟠	🔴 🟠	🟢	🟢
Tomo		🔴 🟠	🔴 🟠	🔴 🟠	🟢	🟢

SEVERITY LEGEND

Symbol	Classification	Possible Implications
🔴	Emergency Situation (Level 3))	- Dam failure imminent or in progress - Emergency remedial measures necessary
🟠	Specialist Review of Situation required immediately (Level 2)	- Could lead to Dam failure - Remedial measure probably required ASAP
🟢	Design and Review Consultants to be notified (Level 1)	- Assessment required within 2 or 3 days

24.12 Appendix L Site Spill Plan

Control	Containment	Clean Up
• Shut down machines & pumps • Close valve • Isolate pipe/ control leak • Use plug & dike (spill kits)	If leak is contained within a bund, drain, pond: • Notify Supervisor • Initiate Clean-up If leak is not contained within a bund, drain, pond: • Use spill trays or empty containers • Build earth or sand bunds • Use absorbent socks and booms (spill kits) • Use spill kit bins to drain off liquids from leaking drums Prevent spill from entering drainage systems Use floating booms/socks if contamination reaches streams and rivers. Call for Environmental Dept.	• Clean up contaminants as soon as possible • Use absorbent mats (can be squeezed out) • Use plastic bags supplied in spill kits or drums • Use absorbent Zeolite (contact Stores or Pit Workshop) All hydrocarbons whether they occur on site or in transit to or from the operations and regardless of size of volume must be cleaned up. All contaminated soils must be excavated, handled, and remediate appropriate to the climatic and operating conditions. Decontaminate equipment, clothing, and personnel on site if safe to do so. Label all contaminated equipment in appropriate storage container/bags.
Spill Disposal: Refer to the Hydrocarbon Management Plan		

Table 9: Class 5 Emulsion Spill Plan

Control	Clean Up
• Shut off all valves • Insert caps into taps after use • Repair or replace leaking hoses • Attempt to seal containers to prevent further spillages. • Follow the SDS for class 5 explosive emulsion • Bund areas should be kept empty and clear of rubbish.	To prevent the likelihood of an accidental ignition from happening, all waste explosive materials must be destroyed as soon as possible. Gasser and Emulsion should be kept from mixing together. • Flush the emulsion to the sump/dilute (small amount of spill) • Contain explosives waste in labelled buckets (more than half pod of ANE spill or leakage) • Store waste buckets in secure magazines • Transfer to location where it may be disposed of in manageable quantities by blasting
Scenario	**Response**
EP spill	**Surface:** Shut off valves and seal containers, build a bund around the spillage and contain waste ANE into buckets
	Underground: Shut off valves and seal containers and flush ANE to sump, seal containers to prevent further spillages
EP spill on Truck/Charmec catches fire	**Surface:** Follow fire emergency plan; Section **1.3 Fire – Surface** **Appendix O Trigger Action Response Plans – T.A.R.P** Shut off valves and seal containers, ANE is not combustible, however, if combustible material is involved in a fire, use large quantities of water.
	Underground: Follow fire emergency plan **1.5 Fire-Underground** Water dropper has been installed in the u/g magazine, use large quantities water to spray, dry agent is **unsuitable.** **Appendix O Trigger Action Response Plans – T.A.R.P**

24.12.1 BP Contingency Plan

The following steps will be followed in the emergency situation of excessive ground movement for removal of one 40,000 litre PUFF tanks at Pit surface storage facility:

1. BP Engineer advised OceanaGold of excessive ground movement in storage tank area. OceanaGold to also advise current levels of fuel in tanks, and if power to PUFF tanks still OK and likely to remain so.
2. BP Engineer to liaise with BP Distribution to arrange tanker/tankers. Response time max 4 hours for tanker/tankers until on site.
3. BP Engineer to liaise with Fuel quip Tauranga to arrange as necessary, tanker hoses, 100 mm bulk diesel driven pump (held at Fuel quip Tauranga) and spill trailer, equipment recovery vehicles Cranes, trucks etc. Response time max 2 hours until on site.
4. BP Engineer to liaise with Commercial Manager, and Incident line then go to site. Response time max 2 hours until on site.

Contacts

- BP Commercial Manager mobile: 021 825 284
- ECL Group Fuel Group Tauranga (for pump assistance) 04-8028400
- BP 24-hour emergency 0800 805 111

Monitoring and Reporting

Refer to procedures:

- Spill Response
- Offsite Spills Discharges Environmental Investigation & Reporting

Safety Data Sheets (SDS)

For specific emergency response to chemical spills refer to official hardcopy SDS available at:

- Baxter Road- First Aid Room
- Mines Rescue
- Chem Alert - various computers

Indicators of Chemical Incident

- Numerous dead animals/birds/fish
- Lack of insect life
- Unexplained odours
    - Fruity to flowery - Sharp/pungent
    - Garlic/horseradish - Almonds/peach - kernel New mown hay
- Mass casualties
- Pattern of casualties
- Blisters/rashes
- Unusual liquid droplets or films
- Ground hugging cloud / fog
- Different looking areas – discoloured, withered, dead
- Unusual debris – metal,
- Time to take effect– chemical symptoms (minutes to hours)

Table 10: Isolation and Protective Zones

	Isolation Zone (m)	Protective Action Zone (m)	
SUBSTANCE	**INITIAL**	**LARGE SPILL**	**FIRE INVOLVED**
Vehicle fire	200		
Diesel	15-25	100	500
LPG	100	800	1500
ANFO	25	100	800
Explosives	-	800	1600
Cyanide	25	250	800
Hydrochloric Acid	25	250	800
Ferric Chloride	25	250	800
Hydrogen Peroxide	25	250	1000
Activated Carbon	-	-	1000

24.13 Cyanide Response Protocols

Refer to Cyanide Management Plan	
Hazards	Inhalation, ingestion, absorption through skin, burns Signs and symptoms of mild or early poisoning include: • Headaches, dizziness, nausea, and vomiting. • Initial rapid breathing followed by a sense of suffocation. • Metallic taste in the mouth. • General weakness, heaviness in the arms and legs. • Skin and eye irritation (a burning sensation) may occur following exposure to the gas, as well as irritation to the nose and throat. Severe cyanide poisoning is characterised by: • A cherry red complexion • Gasping for breath • Loss of consciousness • Cessation of breathing and death.
PPE	Full protection should always be worn • chemical splash goggles • gloves (butyl or neoprene) • PVC suit and PVC boots • Full face mask with cylinder canister OR • Self-contained breathing apparatus • Electronic hydrogen cyanide detector. Self-Contained breathing apparatus; monitoring equipment and personal protective equipment are kept in cabinets located at Mill Office veranda. A PPE (CN) box is also located in the mixing shed. If the wind direction prevents access to the Mill Office veranda, personal protective equipment (PPE) can be obtained from Stores.
First Aid	• Water flush • Oxygen
Medical	• Kit • Refer to SOP's Emergency First Aid & Medical Treatment for Cyanide Poisoning • Call Doctor, Hospital

24.13 Cyanide Response Protocols

Small Spills	• Isolate and protect area • Call for help • Do not approach without wearing appropriate PPE or BA and HCN monitor • Shovel up or flush with water. Place solids in plastic bags or sealed drums. • Monitor and test for contamination.
Large spills (on-site and in transit)	• Initial downwind evacuation for at least 250m • Initiate Emergency Response
Liquid	• Do not attempt to dilute any spillage • Do not linger down wind of spill • where possible, prevent the spread of spilt liquor using earth or sand bunds. Note: Always work upwind of the spill. Keep acids away. - Consider the use of ZEOLITE absorbent that is kept at Stores and the Water Treatment Plant or ferrous sulphate refer SOP - Wait near the scene, at a safe distance, until help arrives to co-ordinate clean-up. - Clean up and remove using ZEOLITE / ferrous absorbent and place in sealed containers for disposal.
Solid Spill	• Consider containment of the area via bunding e.g., if it is raining then the area should be bunded • Sweep up spilled material into a covered container or plastic bag pending transfer • Cover and keep spillage dry • Use ZEOLITE absorbent, if necessary, e.g., if material becomes wet • Call current supplier for guidance

24.13 Cyanide Response Protocols

Fire	• Fire involving large containers in transit, tanks or on site – evacuate for 800 m in all directions • Emergency Response Procedure/Rapid Response • Mobilise fire brigade and Mines Rescue Team • Monitor area for HCN gas • Wear full face mask or self-contained breathing apparatus • Use fog spray or dry powder • Wear full wet weather protective suit (rubber boots to be worn inside wet weather trousers and PVC gloves to be worn inside of wet weather jacket) • If possible, restrict flow of cyanide • Isolate power in immediate area
Containment	• Remain upwind of cyanide or spills and monitor for HCN gas • Avoid contact with water • Water should not be used near quantities of solid cyanide as it can generate large amounts of HCN gas which is highly toxic and highly flammable • Water may be used to fight the fire when in close proximity to liquid cyanide, (note HCN can be evolved) • Dry chemical extinguishers can be used on small fires near cyanide • Construct a bund to contain contaminated water if necessary • Neutralise spill area with ferrous sulphate (in stores: note hazardous substance) • Remove contaminated soil to tailings dam
Emergency Action Points	• Keep an emergency log sheet • Man, incident command post at all times • Ensure mine management is advised of the emergency at first opportunity and kept up to date

Contacts	• Orica	• 0800 734 607
	• National Poison Centre	• 0800 764 766
	• Waihi Medical Centre	• 07 863 8195

Refer to the Emergency Contact Numbers for contact details for following Mill Personnel:

○ Process Manager	○ Metallurgist	○ Process Supervisor

24.14 Appendix M LPG Failure

Initiate Emergency Procedures for all scenarios below

Tank or line fire / leak	All scenarios are to be handled in the same way as outlined below. • **Activate one of the Emergency Stop Buttons on the LPG Vessel** and **Vaporiser System** called the **Donkey Boiler**. These are located by the Cyanide Mixing Shed – Northwest or Northeast corners. This isolates the complete LPG system including the Tank outlets. • **Open the 8” LPG Flood Valve** for the LPG Tank deluge system. This is signposted and has a red handle. This is located on the corner of the access road to the Ball Mill parallel to CV05. If possible, go past the Wooden Water Tanks and check: - Both Process Water Pumps are running **To Contact Rock gas Emergency on 0800 574737, Evacuate the area.** • Go to the South Assembly area. (North Assembly area is too close to the LPG Tanks). • Wardens to ensure guards are in place to prevent access to LPG Tanks and evacuate personnel further away if necessary. **Other precautions:** • Only attempt to isolate and set off the deluge system if you do not put yourself at risk from fire or explosion. • Advise the Fire Service and inform if the tanks are isolated or not and if on fire. • Keep clear of LPG tank ends (explosion hazard)
Liquid Oxygen Leak	• If possible, stop leak by shutting off valve upstream from leak • Contact Supervisor • Keep all personnel up wind and well clear of tank and lines • No smoking or naked flames permitted in area • Wear safety glasses and PVC gloves. When using large quantities or where heavy contamination is likely, wear coveralls. • **Supervisor to contact BOC Gases NZ Ltd 0800 111 333**

24.14 Appendix M LPG Failure

Liquid Carbon Dioxide Leak	• If possible, stop leak by closing valve upstream from leak • Contact Supervisor • Keep personnel up wind and well clear of tank and lines • **Supervisor to contact BOC Gases NZ Ltd 0800 111 333**
Portable Gas Cylinders	• Never attempt to close the valve on a leaking portable gas cylinder, allow the cylinder to discharge itself • If leaking cylinder is in an enclosed space, vacate space immediately and ventilate when possible • Keep personnel up wind and well clear of cylinder • No smoking or naked flames permitted in area • **Report leak to your supervisor**

24.14.1 Fire / Spill - Oxidizing Substances (Hydrogen Peroxide)

- Immediately raise alarm with Security and ask them to contact Mines Rescue and the Fire Brigade,
- Spill or leak area should be isolated immediately for at least 25m in all directions
- Keep upwind and to higher ground
- Large spill - consider initial downwind evacuation for at least 100m
- Fire – Consider initial evacuation for 800m in all directions

Contact : Evonik Degussa Peroxide Ltd

24.14.2 Fire – Flammable Solids (Activated Carbon)

- Immediately raise alarm with Security and ask them to contact the Fire Brigade,
- Keep upwind and to higher ground
- Fire – Consider initial evacuation for 1000m in all directions

24.14.3 Appendix N Radiation Emergency Procedures

A radiation incident is an incident adversely affecting, or likely to adversely affect, the health or safety of any person because of the emission of radiation.

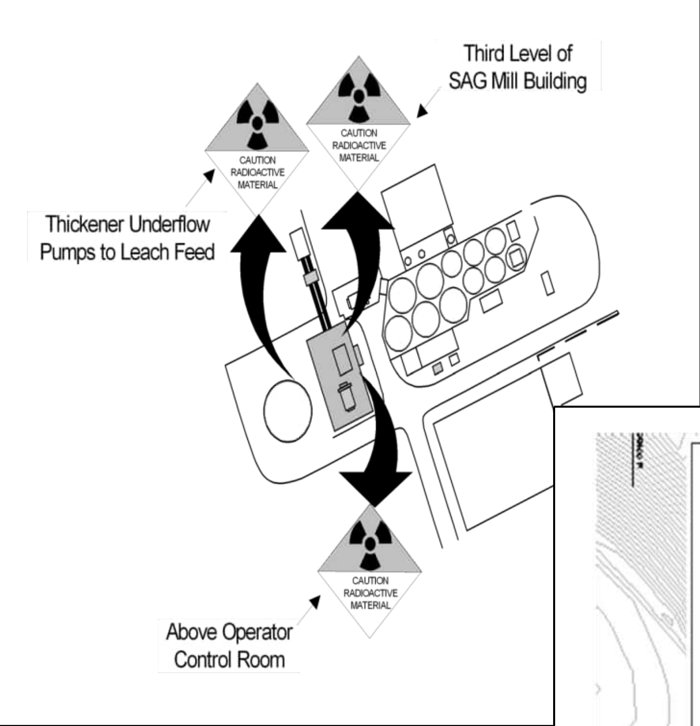
The following examples would trigger a radiation emergency:

- The source housing is found to be leaking because of a test (wipe or metered)
- The gauge was removed for maintenance and was lost or stolen
- The gauge accidentally falls from a height greater than 1 meter, i.e., during a crane lift of the gauge.

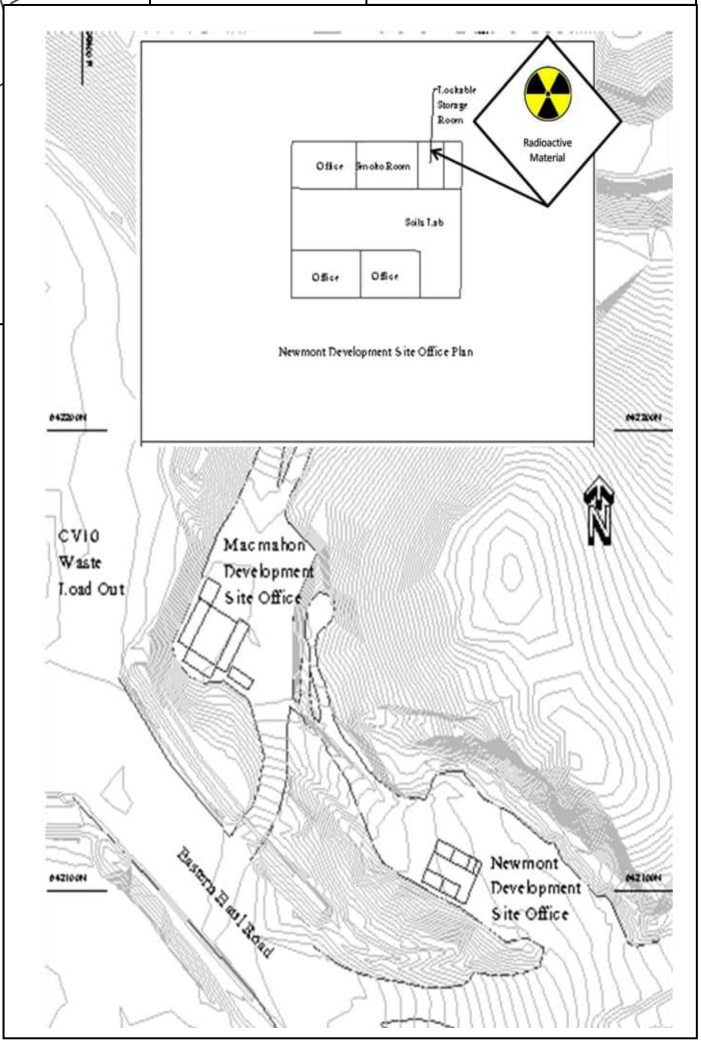
The following emergency procedures are to be implemented in the event of an incident involving an industrial gauge containing radioactive substances.

- Barricade the area with danger tape and restrict access.
- Immediately contact the radiation safety officer. Report the incident to your supervisor, Manager and Operations Manager.
- Do not attempt to move or interfere with the gauge unless directed by the radiation safety officer.
- Remain at an appropriate distance from the gauge (5m minimum). Warn other people in the area and prevent other people entering the barricaded area. Place radiation signs at the entrance to the barricade.
- The Radiation Safety Officer will conduct a radiation survey around the gauge and compare the results with previous monitoring values. The isolation shutter will be turned to the "off" position, and the survey meter used to confirm that shutter is functioning.
- If the radiation measurements are not significantly different, and the source is in the shielded position, the gauge will be returned to the store.
- If the measurements differ significantly from the established values, or the source cannot be returned to the shielded position, the radiation safety officer should determine the course of action to be taken to render the situation safe (e.g., placing additional shielding over the gauge).
- Pending advice from the Radiation Safety Officer, access control must be maintained.
- The Radiation Safety officer will notify the possession licensee and the Director of the NRL if the exposure is over limits. The possession licensee and the NRL are to be advised as soon as possible if a radioactive source is unaccounted for.
- The gauge involved in an incident is not used until the radiation safety officer confirms the safety of the gauge by obtaining a certificate of compliance for the gauge from an appropriately accredited person

Processing Plant



Development Site



24.14.4 Appendix N Pipeline Failure (Tailings or Decant)	
Prevention and Controls	• If possible, stop leak by closing valve upstream from leak • Contact Supervisor • Keep personnel up wind and well clear of tank and lines • **Supervisor to contact BOC Gases NZ Ltd 0800 111 333**
Incident Response	• Turn off pump(s) at source. • If spill is not contained determine the extent of the spillage (a visual check). • If necessary, mobilise equipment to build bunds and contain spill (refer to list of contacts) • The priority is to prevent the flow from entering waterways in particular the Ohinemuri River and Ruahorehore Stream. • Tailing's slurries are to be cleaned up and disposed in tailings pond or pumped to mill. • Any contained decant water to be pumped into a tanker or to collection pond and returned to tailings pond or water treatment plant. • Report to the Environmental Superintendent to coordinate any monitoring, reporting, any further clean up requirements.

24.14.5 Appendix O Cyanide Emergency Procedures	
24.14.5.1 Cyanide Fire	
PURPOSE	• To provide guidelines for responding to a fire in close proximity to cyanide
HAZARDS	• **Cyanide usually fatal if ingested, absorbed through the skin or HCN gas inhaled** • **Burns from fire if trapped** • **Smoke inhalation**
RISK ASSESSMENT	• High
SITE EMERGENCY COORDINATOR	• Area Manager (depending on availability)
RESPONSE TO HAZARDS	• Do not risk life • Mobilise fire brigade and Mines Rescue Team

24.14.5 Appendix O Cyanide Emergency Procedures

	• Monitor area for HCN gas
	• Wear full face mask or self-contained breathing apparatus
	• Wear full wet weather protective suit (rubber boots to be worn inside wet weather trousers and PVC gloves to be worn inside of wet weather jacket)
	• Keep area clear of bystanders
	• If possible, restrict flow of cyanide
	• Isolate power in immediate area
EVACUATION	• All non-emergency personnel to be moved to a muster point or area at least 200m upwind
CONTAINMENT	• Remain upwind of cyanide or spills and monitor for HCN gas
	• Water should not be used near quantities of solid cyanide as it can generate large amounts of HCN gas which is highly toxic and highly flammable
	• Water may be used to fight the fire when in close proximity to liquid cyanide, (Note HCN can be evolved)
	• Dry chemical extinguishers can be used on small fires near cyanide
	• Construct a bund to contain contaminated water if necessary
	• Neutralise spill area with ferrous sulphate
	• Remove contaminated soil to tailings dam
SPECIAL EQUIPMENT	• Firefighting equipment
	• Breathing apparatus or full-face respirator and appropriate filter
	• Ambulance with additional oxygen equipment on standby
EMERGENCY ACTION POINTS	• Ensure Site Emergency Co-ordinator is given requested support • Keep an emergency log sheet
	• Man incident command post at all times
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date

24.14.5 Appendix O Cyanide Emergency Procedures	
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers
EXTERNAL RESOURCES	National Poison Centre 0800 764 766 Waihi Medical Centre 863 8195

24.14.5.2 Solid Cyanide Spillage in Transit	
PURPOSE	• To provide guidelines for responding to a solid cyanide spill in transit
HAZARDS	• Cyanide usually fatal if ingested, absorbed through the skin, dust enters eyes, or HCN gas inhaled
	• Fire if truck damaged
	• Environmental damage
RISK ASSESSMENT	• High
SITE EMERGENCY COORDINATOR	• New Zealand Emergency Services (fire brigade/police) • Contact Orica for specialist advice
	• Mobilise Rapid Response Team
RESPONSE TO HAZARDS	• **Do not risk life** • Mobilise Mines Rescue Team if required
	• Monitor area for HCN gas
	• Wear full face mask with appropriate filter or BG4
	• Wear full wet weather protective suit (rubber boots to be worn inside wet weather trousers and PVC gloves to be worn inside of wet weather jacket)
	• Keep area clear of bystanders
EVACUATION	• All non-emergency personnel to be kept clear of the area
CONTAINMENT	• Remain upwind of cyanide or spills and monitor for HCN gas
	• Avoid contact with water
	• Shovel up all of the spilled solid and place in plastic bags or sealed drums

24.14.5.2 Solid Cyanide Spillage in Transit	
	• Sweep up remaining particles carefully
	• Neutralise spill area with ferrous sulphate
SPECIAL EQUIPMENT	• Breathing apparatus or full-face respirator and appropriate filter
	• Ambulance with additional oxygen equipment on standby
EMERGENCY ACTION POINTS	• Ensure Site Emergency Co-ordinator is given requested support. • Keep an emergency log sheet
	• Man, incident command post at all times
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers
EXTERNAL RESOURCES	NZ Police 111
	FENZ 111
	Orica 0800 734 607
	Walters Transport 09 258 5090 or 0274 404 257
	National Poison Centre 0800 764 766

24.14.5.3 Cyanide Contact (Poisoning)	
PURPOSE	• To provide guidelines for responding to a cyanide poisoning
HAZARDS	• Cyanide usually fatal if ingested, absorbed through the skin, dust enters eyes, or HCN gas inhaled
RISK ASSESSMENT	• Moderate
SITE EMERGENCY CO-ORDINATOR	• Area Manager (depending on availability)
RESPONSE TO HAZARDS	• **Do not risk life** • Enter safety shower and remove clothes (flush affected areas for at least 15 minutes)
	• Do not lift contaminated shirt over casualty's head
	• Raise alarm and mobilise Mines Rescue Team
	• Monitor area for HCN gas
	• Rescuers to wear full face mask with appropriate filter or SCBA if required
	• Keep area clear of bystanders
EVACUATION	• All non-emergency personnel to be kept clear of the area
CONTAINMENT	• Remain upwind of cyanide or spills and monitor for HCN gas
	• Restrict flow of cyanide if required
SPECIAL EQUIPMENT	• Breathing apparatus or full-face respirator and appropriate filter
	• Ambulance with additional oxygen equipment on standby
EMERGENCY ACTION POINTS	• Ensure Site Emergency Co-ordinator is given requested support • Keep an emergency log sheet
	• Man, incident command post at all times
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers
EXTERNAL RESOURCES	National Poison Centre 0800 764 766
	Waihi Medical Centre 07 863 8195

24.14.5.4 High HCN Levels in Leach Circuit	
PURPOSE	• To provide guidelines for responding to high HCN gas levels in the leach/adsorption tanks area
HAZARDS	• Cyanide usually fatal if sufficient quantities HCN gas inhaled
RISK ASSESSMENT	• Moderate
SITE COORDINATOR	• Area Manager
	• Plant Metallurgist
	• Senior Process Supervisor
RESPONSE TO HAZARDS	• **Do not risk life** • Wear full face mask with appropriate filter
	• Continue regular monitoring for HCN gas
	• Keep area clear of bystanders – use barricade tape
EVACUATION	• All non-emergency personnel to be kept clear of the area
CONTAINMENT	• Notify Supervisor and Mill Manager of high HCN levels
	• Increase lime addition to leach tank
	• Shut off cyanide flow
	• Barricade affected areas
	• Test HCN levels regularly with full face respirator and filter
	• Return to normal operation once HCN levels are below 2.5 ppm.
SPECIAL EQUIPMENT	• Full face respirator and appropriate filter
	• Ambulance with additional oxygen equipment on standby
EMERGENCY ACTION POINTS	• Ensure Site Emergency Co-ordinator is given requested support • Keep an emergency log sheet
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers
EXTERNAL RESOURCES	Nil

24.14.5.5 Liquid Cyanide Spill

PURPOSE	• To provide guidelines for responding to a liquid cyanide spill
HAZARDS	• Cyanide usually fatal if ingested, absorbed through the skin, or HCN gas inhaled
	• Environmental damage
RISK ASSESSMENT	• Moderate
SITE EMERGENCY COORDINATOR	• Area Manager
RESPONSE TO HAZARDS	• **Do not risk life** • Mobilise Mines Rescue Team if required
	• Wear full face mask with appropriate filter or BA equipment
	• Monitor area for HCN gas
	• Wear full wet weather protective suit (rubber boots to be worn inside wet weather trousers and PVC gloves to be worn inside of wet weather jacket)
	• Keep area clear of bystanders
EVACUATION	• All non-emergency personnel to be kept clear of the area
CONTAINMENT	• Remain upwind of cyanide or spills and monitor for HCN gas
	• If possible, stop cause of spillage
	• If spill not in bunded area, construct an earth bund to contain
	• Pump spillage back to holding tank, process, or tailings dam
	• Neutralise spill area with ferrous sulphate
	• If necessary, remove contaminated soil to tailings dam
SPECIAL EQUIPMENT	• Breathing apparatus or full-face respirator and appropriate filter
	• Pump and hoses
	• Skid steer loader and/or FEL
EMERGENCY ACTION POINTS	• Ensure Site Emergency Co-ordinator is given requested support • Keep an emergency log sheet
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date

24.14.5.5 Liquid Cyanide Spill		
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers	
EXTERNAL RESOURCES	National Poison Centre	0800 764 766
	Waihi Medical Centre	863 8195

24.14.5.6 Solid Cyanide Spill		
CONTAINMENT	• Remain upwind of cyanide or spills and monitor for HCN gas	
	• Avoid contact with water	
	• Shovel up all of the spilled solid and place in plastic bags or sealed drums	
	• Sweep up remaining particles carefully	
	• Neutralise spill area with ferrous sulphate	
SPECIAL EQUIPMENT	• Breathing apparatus or full-face respirator and appropriate filter	
	• Ambulance with additional oxygen equipment on standby	
EMERGENCY ACTION POINTS	• Ensure Site Emergency Co-ordinator is given requested support • Keep an emergency log sheet	
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date	
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers	
EXTERNAL RESOURCES	National Poison Centre	0800 764 766
	Waihi Medical Centre	07 863 8195

24.14.5.7 Tailings Line Spill	
PURPOSE	• To provide guidelines for responding to a tailings line spill
HAZARDS	• Cyanide usually fatal if ingested, absorbed through the skin, dust enters eyes, or HCN gas inhaled
	• Environmental damage
RISK ASSESSMENT	• Moderate
SITE EMERGENCY COORDINATOR	• Area Manager
RESPONSE TO HAZARDS	• Do not risk life • Mobilise Mines Rescue Team if required
	• Keep area clear of bystanders
EVACUATION	• All non-emergency personnel to be kept clear of the area
CONTAINMENT	• Turn off pumps at source
	• If spill is not contained determine the extent of the spillage (a visual check)
	• Mobilise equipment to build bunds and contain spill if required
	• Prevent the flow from entering waterways, in particular the Ohinemuri River
	• Tailing slurries are to be cleaned up and disposed in tailings pond or pumped to mill
SPECIAL EQUIPMENT	• Skid steer loader and/or bobcat
EMERGENCY ACTION POINTS	• If involved ensure Site Emergency Co-ordinator is given requested support • Keep an emergency log sheet
	• Ensure mine management is advised of the emergency at first opportunity and kept up to date
	• Report to the Environmental Manager to coordinate any monitoring, reporting, any further clean up requirements.

24.14.5.7 Tailings Line Spill	
EMERGENCY CONTACTS	• See general listing of all contact telephone numbers
EXTERNAL RESOURCES	• Nil

LIST OF CYANIDE EMERGENCY SUPPLIER CONTACT	
ORICA 0800 734 607	**ORICA 00613 9663 2130**

24.15 Appendix P Trigger Action Response Plans – T.A.R.P

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Table 11: Serious Injury / Accident (On and off-site including fatality)

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• First aid injury • Minor accident/incident	• Medically treated injury and lost time injury • Reportable accident/incident (Broken bones / serious harm) • Incident requiring ambulance transport	• Serious injury / fatality. • Major accident/incident • Reportable accident/incident (broken bones / serious harm) • Delay in accessing injured person at offsite location (including level 2 events)
All Personnel	• Administer first aid • Record treatment • Complete incident report • Notify supervisor	• Quickly assess the situation and make emergency call. • Administer first aid • Assess the situation and requirements	• Quickly assess situation and make emergency call. • Administer first aid and withdraw all persons to a place of safety. • Prevent persons from entering the area until a thorough assessment has been carried out. (Preserve the area)
Emergency Call Taker	• No action required	• Follow procedures as per duty card	• Follow procedures as per duty card
Supervisor	• Record and report • Notify department manager if required	• Request Mines Rescue Team and equipment for immediate response if required • Update emergency call taker on situation • Notify department manager	• Request Mines Rescue Team and equipment for immediate response • Update emergency call taker on situation and advise what other resources may be required • Secure the area • Notify department manager • Be the mine incident controller until department manager takes over.

	Level 1 Response	Level 2 Response	Level 3 Response
Emergency Response Coordinator	• Assist with first aid if required	• Coordinate emergency response personnel • Assist with first aid treatment • Liaise with ambulance / Helicopter services - standby	• Coordinate emergency response personnel • Assist with first aid treatment • Activate Helicopter service • Set up Helicopter landing area
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate	• Liaise with ER coordinator and Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify chief operating officer • Notify WorkSafe when appropriate • Notify Police (police / WorkSafe to investigate fatalities)
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold crisis management plan if required.

Table 12: Multi Casualty Incident

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Multiple minor first aid injuries • Minor accident/incident with no major injuries	• Multiple (3 or more) medically treated injury and lost time injury Multiple reportable accident/incident (Broken bones / serious harm) • Incident requiring ambulance transport	• Incident with three or more casualties requiring ambulance transport • An incident with more than two seriously injured persons • Major Accident/Incident (Broken bones / serious harm)
All Personnel	• Administer first aid • Record treatment • Complete incident report • Notify supervisor	• Quickly assess the situation and make emergency call. • Administer first aid • Assess the Situation and requirements	• Quickly assess situation and make emergency call. • Administer first aid and withdraw all persons to a place of safety. • Prevent persons from entering the area until a thorough assessment has been conducted.
Emergency Call Taker	• No action required	• Follow procedures as per duty card	• Follow procedures as per duty card
Emergency Response Coordinator	• Assist with first aid if required	• Assist with first aid treatment • Coordinate emergency response personnel • Liaise with Ambulance / Helicopter services - standby	• Assist with first aid treatment • Coordinate emergency response personnel • Activate Helicopter service • Set up Helicopter landing area
Supervisor	• Record and report Notify department manager if required	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Incident Controller until Department Manager takes over.

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager **(Mine Incident Controller)**	• Assist with first aid if required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 13: Fire – Surface

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Small fire that can be controlled with immediately available personnel / fire extinguisher	• Fire that that requires ER Members and may require external emergency service involvement.	• Fire that involves critical infrastructure endangers personnel and will require urgent external emergency service involvement. • (See tyre fire if tyres involved or contact with electricity)
All Personnel	• If you can extinguish the fire, take immediate action to do so. • Determine the safest route of travel to place of safety	• If you can extinguish the fire, take immediate action to do so. • Quickly assess the situation and make emergency call • Determine safest route of travel to place of safety Notify other persons in the area of fire.	• Quickly assess the situation and make emergency call Determine safest route of travel to Place of Safety • Notify other persons in the area of fire.
Emergency Call Taker	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Emergency Response Coordinator	• On standby	• If you can extinguish the fire, take immediate action to do so. • Quickly assess the situation and make emergency call • Deploy MRT	• Ensure perimeter is in place • Assess other potential areas of threat • Liaise with external fire services
Supervisor	• Monitor situation and maintain contact with reporting person. Complete Incident Report	• Notify Department Manager • Dispatch Mines Rescue Team and equipment for immediate response. • Complete Incident Report	• Request Mines Rescue Team and equipment for immediate response Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Follow up incident analysis.	• Notify General Manager and/or SSE • Follow up incident analysis. • Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement Crisis Management Plan if required. Report occurrence to Authority as required.

Table 14: Machinery / Tyre Fire

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A minor machinery/tyre fire that has been extinguished	• A fire that can be controlled by on a site response A fire that has resulted in injuries	• A significant machinery/tire fire that cannot be controlled safely. A fire that has potential to spread to other infrastructure
All Personnel	• Notify Supervisor • Complete Incident Report	• Quickly assess the situation and make emergency call. • Attempt to extinguish only if safe to do so • If unable to extinguish reassess the situation and requirements. • Tyre fire – 300 metre exclusion set up	• Quickly assess situation and make emergency call. • Withdraw all persons to a place of safety. • Prevent persons from entering the area.
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Follow machinery tire fire procedure Record and Report. • Notify Department Manager if required	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Activate on site ER response	• Activate on site ER response • Liaise with external emergency services re requirements

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 15: Fire - Underground

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A small underground fire that has been found	• A smell of smoke underground with no immediate known cause.	• Any confirmed uncontrolled underground fire.
All Personnel	• Make emergency call on radio • Don self-rescuer if required • If you can extinguish the fire, take immediate action to do so. • Determine the safest route of travel to place of safety	• Quickly assess the situation and make emergency call • Don self-rescuer if required • Determine safest route of travel to Place of Safety	• Quickly assess the situation and make emergency call • Don self-rescuer if required • Determine safest route of travel to Place of Safety
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Monitor situation and maintain contact with reporting person. Complete Incident Report	• Request ER team and equipment for immediate response. • Notify Department Manager • Complete Incident Report	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over
Emergency Response Coordinator	• No action required	• Initiate on site MRT response • Coordinate MRT response	• Initiate on site MRT response • Activate offsite MRT call in • Coordinate MRT response
Department Manager (Mine	• Follow up incident analysis.	• Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate	• Activate and coordinate the MRT • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT)

	Level 1 Response	Level 2 Response	Level 3 Response
Incident Controller)			• Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement Crisis Management Plan. • Report occurrence to Authority as required.

Table 16: Weather Event

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A significant weather event is forecast •	• A significant weather event is in progress and current plans are not sufficient • Access to the site is compromised • An injury/illness requiring external medical aid occurs while site access is compromised	• Access/egress is not possible • A serious injury/illness occurs while access/egress is not possible
All Personnel	• No action required	• No action required	• Follow instructions from supervisor and assist if possible.
Emergency Call Taker	• No action required	• No action required	• Follow procedures as per appropriate duty card
Supervisor	• Assist Manager with planning for event • Monitor conditions and forecasts	• Contact Emergency Response Coordinator • Contact Department Manager • Monitor conditions and monitoring equipment e.g., rain gauges	• Contact Emergency Response Coordinator • Contact Department Manager • Consider shutting down non-essential operations • Monitor conditions and forecasts
Emergency Response Coordinator	• Assist Managers with planning for event	• Arrange access for medical treatment Assist with planning to manage event	• Arrange phone/radio medical link • Assist with planning to manage event
Department Manager (Mine Incident Controller)	• Establish plan to manage event • Notify General Manager and/or SSE of plans	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate	• Activate and Coordinate the Mine Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate

	Level 1 Response	Level 2 Response	Level 3 Response
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 17: Tailings Impoundment Failure

	Level 1 Response	Level 2 Response	Level 3 Response
Triggers	• A slump of < 1 metre	• A slump of 1-3 metres with >24-48 hour.	• A sudden failure or a slump of over 1 metre with no warning.
All Personnel	• Notify supervisor. • Assess the situation from safe location • Identify location Time recorded.	• Notify supervisor. • Assess the situation from safe location Identify personnel in danger etc. • Notify other persons in the area.	• Quickly assess the situation and make emergency call Determine safest route of travel to Place of Safety • Notify other persons in the area.
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Suspend operations in vicinity of movement. • Notify Department Superintendent or • Department Manager • Increase monitoring frequencies.	• Suspend operations in vicinity of movement. • Consider evacuation from surrounding areas • Notify Department Superintendent or • Department Manager • Prepare Mines Rescue Team and equipment for immediate response.	• Initiate evacuation if required and not already done • Dispatch Mines Rescue Team and equipment for immediate response if personnel missing. • Notify Department Superintendent or Department Manager • Be the Mine Incident Controller until Department Superintendent or • Department Manager takes over • Complete a head count of all personnel.

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Notify technical personnel. • Initiate appropriate mitigation measures. Monitor & record situation	• Notify technical personnel. • Refer to Tailing's storage facility emergency action plan for detailed • Initiate appropriate mitigation measures. • Increase monitoring frequencies. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and coordinate Mines Rescue Team. • Initiate appropriate mitigation measures. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager (SSE)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement Crisis Management Plan if required

Table 18: Mining – Vehicle Accident

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A vehicle incident with no or minor injuries	• A vehicle incident with moderate injuries requiring external medical intervention	• A vehicle incident with serious injuries, trapped personnel, under heavy vehicle, over a berm or other significant risk exposures
All Personnel	• Administer first aid • Record treatment • Complete Incident Report • Notify Supervisor	• Quickly assess the situation and make emergency call. • Administer first aid • Assess the Situation and requirements	• Quickly assess the situation and make emergency call. • Administer first aid • Assess the situation and requirements
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Record and Report. • Notify Department Manager if required	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Organise onsite medical response • Liaise with external medical responders re treatment if required	• Organise onsite medical response • Liaise with external medical responders re treatment if required

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 19: Explosives Emergency

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Report only incidents	• An unplanned detonation of explosives with no injuries • Report of missing explosives	• An unplanned detonation of explosives with serious injuries A fire involving explosives • Missing explosives
All Personnel	• Report irregularities	• Quickly assess the situation and make emergency call. Administer first aid • Assess the Situation and requirements	• Quickly assess situation and make emergency call. • Administer first aid and withdraw all persons to a place of safety. • Prevent persons from entering the area until a thorough assessment has been carried out. • Roadblocks and exclusion zones set up
Emergency Call Taker	• No Action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Document incident	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager • Ensure explosives exclusion zone is set up as per emergency map • Refer to explosives Emergency Action Plan	• Request Mines Rescue Team and equipment for immediate response Update Emergency Call Taker on situation and advise what other resources may be required • Ensure explosives exclusion zone is set up as per emergency map Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No Action required	• Assist with perimeter control • Refer to explosives Emergency Action Plan	• Initiate onsite ER medical response • Assess scene safety prior to allowing ER access

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No Action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Refer to explosives Emergency Action Plan Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No Action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No Action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 20: Explosives Fire Emergency

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Report only incidents	• Fire within 10m of an Explosive Magazine	• A fire within the Explosive Magazine
All Personnel	• Report irregularities	• Quickly assess the situation and make emergency call. • Evacuate non-emergency personnel to nearest Muster Point • Assess the Situation and requirements • Send personnel to evacuate and restrict access within cordon area on • Domain Road and Moore Street. See Appendix A Site Layout Plan & Alternative Access Points	• Quickly assess situation and make emergency call. • Evacuate all personnel to nearest Muster Point • Assess the Situation and requirements • Send personnel to evacuate and restrict access within cordon area on Domain • Road and Moore Street. See **Error! Reference source not found.**
Emergency Call Taker	• No Action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Document incident	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager • Ensure explosives exclusion zone is set up as per emergency map • Refer to explosives Emergency Action Plan	• Request Mines Rescue Team and equipment for immediate response Update Emergency Call Taker on situation and advise what other resources may be required • Ensure explosives exclusion zone is set up as per emergency map Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No Action required	• Assist with perimeter control • Deploy MRT • Notify and Liaise with Fire and Emergency NZ	• Assess scene safety prior to allowing ER access • Deploy MRT • Notify and Liaise with Fire and Emergency NZ

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No Action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT)	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No Action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No Action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 21: Pit Wall Failure

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Movement alarm activation as per ground movement TARPs	• A large movement which has blocked egress for personnel • A movement which has the potential to affect the underground operations	• A large failure with personnel missing/trapped • A large failure that has blocked access/egress from the underground operations
All Personnel	• Follow instructions from supervisors	• Quickly assess the situation and make emergency call.	• Quickly assess situation and make emergency call. Withdraw all persons to a place of safety. • Prevent persons from entering the area
Emergency Call Taker	• No action required	• Follow instructions from supervisor	• Follow procedures as per appropriate duty card
Supervisor	• Investigate • Record and Report. • Contact appropriate person to inspect if required • Notify Department Manager if required	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager • Geotechnical officer notified	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Geotechnical officer notified • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• On standby	• No action required	• Initiate on site MRT response • Coordinate MRT response

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager (SSE) • Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager (SSE) • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate • Notify Chief Operating Officer if required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 22: Major Strata Failure – Earthquake

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• An actual or indicated failure that is contained to a specific area of the operation and is not threatening any other areas	• An actual or indicated failure that is impacting or threatening multiple areas of the operation	• An actual failure that has blocked normal access/egress or has resulted in missing persons
All Personnel	• No action required	• No action required	• Quickly assess situation and make emergency call. • Administer first aid and withdraw all persons to a place of safety. • Prevent persons from entering the area
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Close off area and initiate geotechnical investigation • Notify Department Manager	• Initiate evacuation to surface • Notify Department Manager • Initiate geotechnical investigation	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Support the evacuation process • Place onsite ER team on standby until complete evacuation confirmed	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response
Department Manager (Mine Incident Controller)	• Monitor situation and maintain contact with reporting person.	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE

	Level 1 Response	Level 2 Response	Level 3 Response
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 23: Entrapment

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Report of minor rock fall	• Any incident that will result in people having to use the escape way for egress	• Any incident that has resulted in people being trapped and unable to exit the mine.
All Personnel	• Retreat from area fall has occurred	• Follow instructions	• Follow instructions
Emergency Call Taker	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Organise safe inspection of the area	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• On standby	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response
Department Manager (Mine Incident Controller)	• Monitor situation	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate

	Level 1 Response	Level 2 Response	Level 3 Response
General Manager and/or SSE	• Notified only	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 24: Flooding

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• The possibility of flooding in the next 24 hours	• A sudden flooding event with potential to trap personnel Significant pit flooding that has real potential to affect the underground workings	• Sudden flooding event that has trapped personnel A sudden flooding event with missing personnel
All Personnel	• Assist as required	• Quickly assess the situation and make emergency call. • Withdraw to place of safety • Prevent persons from entering the area until a thorough assessment has been conducted.	• Quickly assess the situation and make emergency call. Withdraw to place of safety • Prevent persons from entering the area until a thorough assessment has been conducted.
Emergency Call Taker	• Follow procedures as per appropriate duty card	• • Follow procedures as per appropriate duty card	• • Follow procedures as per appropriate duty card
Supervisor	• Follow planning procedures for possible flooding • Notify Department Manager if required • Assist with planning	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• On standby	• Initiate on site ER response Coordinate ER response	• Initiate on site ER response Coordinate ER response

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required

Table 25: Process Plant – Chemical Spill and/or Gas Leak

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Localised minor chemical spill of known chemical that can be contained with immediate equipment (On site ER members • and other personnel)	• Chemical spillage that requires offsite ER Members and may require external emergency service involvement • A gas event without any personnel overcome/injured	• Spillage of dangerous chemical that cannot be contained with immediately available equipment and will require urgent external emergency service involvement. • A major LPG leak that cannot be immediately controlled • A dangerous gas event with personnel overcome/injured
All Personnel	• Determine type of chemical. • Assess the situation • Take immediate action to localise spill to prevent further spillage. • Notify supervisor. • Complete Incident Report	• Quickly assess the situation and make emergency call. Administer first aid if safe to do so and withdraw all persons to a place of safety. • Take immediate action to localise spill to prevent further spillage if safe to do so. • Prevent persons from entering the area until a thorough assessment has been conducted.	• Quickly assess situation and make emergency call. • Administer first aid if safe to do so and withdraw all persons to a place of safety. • Prevent persons from entering the area until a thorough assessment has been conducted. Notify supervisor
Emergency Call Taker	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card

	Level 1 Response	Level 2 Response	Level 3 Response
Supervisor	• Monitor situation and maintain contact with reporting person. • Ensure appropriate paperwork is completed.	• Request Mines Rescue Team and equipment for immediate response • Initiate evacuation if required and not already done • Update Emergency Call Taker on situation • Notify Department Manager	• Request ER team and equipment for immediate response • Initiate evacuation if required and not already done • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over
Emergency Response Coordinator	• On Standby	• Initiate on site ER response Liaise with fire services	• Initiate on site ER response Liaise with fire services
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Take control of incident as Mine Incident Controller • Activate and coordinate the Mines Rescue Team if required • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate

	Level 1 Response	Level 2 Response	Level 3 Response
Chief Operating Officer	• No action required	• No action required	• Implement Crisis Management Plan if required Report occurrence to Authority as required.

Table 26: WAH Rescue Incident

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A person requires assistance to exit an elevated work area (work at height).	• A person has a minor injury from a fall or may be trapped or suspended by their fall arrest equipment and it may be necessary to undertake a "height rescue" using site personnel.	• A person has a major injury from a fall or may be trapped or suspended by their fall arrest equipment and requires immediate evacuation "height rescue" using site personnel.
All Personnel	• Assist as required as per rescue plan on Working at Height permit	• Quickly assess the situation and make emergency call. • Have first aid administered by other personnel on the Working at Height permit • Assess the Situation and requirements	• Quickly assess situation and make emergency call. • Withdraw all persons to a place of safety. • Prevent persons from entering the area until a thorough assessment has been conducted.
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Ensure action is taken and incident report is completed	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• Assist as required – stand by	• Initiate on site ER response • Assist coordinating ER response • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Notified	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE
General Manager (SSE)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 27: Confined Space Incident

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A person has a minor injury and requires assistance to exit a confined space.	• A person has an injury that needs immediate treatment in a confined space and is unable to exit without assistance.	• A person has collapsed in a confined space for no obvious reason.
All Personnel	• Assist as required as per rescue plan on confined space permit	• Quickly assess the situation and make emergency call. • Have first aid administered by other personnel on the confined space permit • Assess the Situation and requirements	• Quickly assess situation and make emergency call. • Withdraw all persons to a place of safety. • Prevent persons from entering the area until a thorough assessment has been conducted.
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Ensure action is taken and incident report is completed	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• Assist as required – stand by	• Initiate on site ER response • Assist coordinating ER response • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Notified	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE
General Manager (SSE)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 28: Explosion

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Any unplanned initiation of explosives that has not impacted on personnel and is confined to a small area	• Unplanned detonation of explosives, chemicals or other devices that has impacted multiple areas of the operation.	• Unplanned initiation of a set charge or shot that has impacted upon personnel or resulted in missing personnel
All Personnel	• No action required	• Follow instructions	• Quickly assess situation and make emergency call. • Administer first aid and withdraw all persons to a place of safety. • Prevent persons from entering the area
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Close off area and initiate geotechnical investigation • Notify Department Manager	• Initiate evacuation to surface • Notify Department Manager • Initiate geotechnical investigation	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Support the evacuation process • Place onsite ER team on standby until complete evacuation confirmed	• Initiate on site ER response Activate offsite ER call in • Coordinate ER response

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Monitor situation and maintain contact with reporting person	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
General Manager and/or SSE	• . No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required		• Implement OceanaGold Crisis Management Plan if required.

Table 29: Missing Persons

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Any person that has not cleared their tag prior to firing times and is not able to be contacted or found underground (Believed offsite)	• Any person that has not removed their tag and who's personal belongings are still on site.	• Any person that cannot be contacted or found after going to do re-entry
All Personnel	• No action required	• No action required	• Follow instructions
Emergency Call Taker	• No action required	• No action required	• Follow procedures as per appropriate duty card
Supervisor	• Record and Report. • Search for missing person/ confirm if on or off site • Notify Department Manager	• Notify Department Manager • Initiate systematic search of underground • Contact Emergency Response Coordinator	• Contact Emergency Response Coordinator and request Mines Rescue Team and equipment for immediate BA search. • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Place onsite ER team on standby until complete evacuation confirmed	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response
Department Manager (Mine Incident Controller)	• Approve firing or not	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate

	Level 1 Response	Level 2 Response	Level 3 Response
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 30: Inrush

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A flooding or inrush event has happened and is contained to a specific area of the operation and is not threatening personnel or any other areas.	• A potential imminent flooding or inrush event has been identified • A flooding/inrush event has occurred that has impacted upon multiple areas of the operation and or personnel	• A flooding/inrush event has occurred, and personnel are unaccounted for.
All Personnel	• Follow instructions	• Quickly assess the situation and make emergency call. • Administer first aid	• Quickly assess situation and make emergency call. • Administer first aid and withdraw all persons to a place of safety. • Prevent persons from entering the area
Emergency Call Taker	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Initiate evacuation to surface. • Notify Department Manager if required Record and Report	• Initiate evacuation to surface • Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Initiate on site ER response Coordinate ER response	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 31: Vehicle Collision (persons trapped)

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• Any vehicle or equipment collision that involves a single casualty who can be transported to or accessed by medical aid without delay	• Any vehicle or equipment collision that involves a trapped casualty or more than 1 but less than 5 casualties	• Any vehicle or equipment collision that involves more than 5 casualties or has casualties with life threatening injuries
All Personnel	• Administer first aid • Record treatment • Complete Incident Report Notify Supervisor	• Quickly assess the situation and make emergency call. • Administer first aid • Assess the Situation and requirements	• Quickly assess situation and make emergency call. • Administer first aid • Prevent persons from entering the area until a thorough assessment has been conducted.
Emergency Call Taker	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Record and Report. • Notify Department Manager if required	• Request Mines Rescue Team and equipment for immediate response if required • Update Emergency Call Taker on situation • Notify Department Manager	• Request Mines Rescue Team and equipment for immediate response • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Initiate on site ER response Coordinate ER response	• Initiate on site ER response • Activate offsite ER call in • Coordinate ER response • Liaise and coordinate external emergency service underground response

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 32: Violence/Bomb Threat

	Level 1 Response	Level 2 Response	Level 3 Response	Level 3 Response
Trigger	• Threat of Violence or Physical • Harm	• Incident of Violence or Physical • Harm	• Continuing Violence or Actual Physical Harm	• Bomb Threat/Suspect Package
All Personnel	• Remain calm and treat ALL threats as genuine. • Give the offender what they want if possible • Phone Call- • Try to calm an irritated caller Ask them what they want • Quietly (to avoid panic) • DO NOT hang up your telephone when the call is completed. Notify Supervisor	• Remain calm and treat ALL threats as genuine. • Give the offender what they want if possible • Notify Supervisor	• Remain calm and treat ALL threats as genuine. • Give the offender what they want, if possible, Notify Supervisor	• Quietly (to avoid panic) advise Supervisor • Note down what you remember of the package
Emergency Call Taker	• Report to supervisor	• Report to supervisor	• Report to supervisor	• Report to supervisor
Supervisor	• Remove personnel from danger area • Contact police if required	• Evacuate personnel from danger area • Notify Department Manager • Contact police if required	• Initiate evacuation if required • Notify Department Manager • Be the Mine Incident Controller until the Department Manager arrives	• Initiate evacuation • Notify Department Manager • Be the Mine Incident Controller until the Department Manager arrives
Emergency Response Coordinator	• Assist as required	• Place onsite ER team on standby until complete evacuation confirmed	• Place onsite ER team on standby until complete evacuation confirmed	• Place onsite ER team on standby until complete evacuation confirmed

	Level 1 Response	Level 2 Response	Level 3 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Notify General Manager and/or SSE	• Notify General Manager and/or SSE	• Assess the situation • Activate Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Ensure evacuation is underway • Activate Mines Rescue Team • Notify General Manager and/or SSE • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person.	• Monitor situation • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required Notify WorkSafe when appropriate	• Assess situation • Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Monitor situation and maintain contact with reporting person • Implement Crisis Management Plan if required	• Implement Crisis Management Plan if required

Table 33: General – Illness

	Level 1 Response	Level 2 Response	Level 3 Response
Chief Operating Officer	• No action Required	• No Action Required	• Implement OceanaGold Crisis Management Plan if required.

Table 34: Helicopter Incident

	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• A helicopter incident with no or minor injuries	• A helicopter incident with moderate injuries requiring external medical intervention	• A helicopter incident with serious injuries, and/or missing or downed aircraft.
All Personnel	• Administer first aid • Record treatment • Complete Incident Report • Notify Supervisor	• Quickly assess the situation and make emergency call. Administer first aid • Assess the Situation and requirements	• Quickly assess the situation and make emergency call. Administer first aid • Fire extinguishment • Assess the situation and requirements
Emergency Call Taker	• No action required	• Follow procedures as per appropriate duty card	• Follow procedures as per appropriate duty card
Supervisor	• Record and Report. • Notify Department Manager if required	• Notify Emergency Response Coordinator • Update Emergency Call Taker on situation • Notify Department Manager	• Notify Emergency Response Coordinator • Update Emergency Call Taker on situation and advise what other resources may be required • Secure the area • Notify Department Manager • Be the Mine Incident Controller until Department Manager takes over.
Emergency Response Coordinator	• No action required	• Contact aviation contractor to ensure their emergency process is being conducted • Organise onsite medical response • Liaise with external medical responders re treatment if required • Gain information from aviation contractor	• Contact aviation contractor to ensure their emergency process is being conducted • Organise onsite medical response • Liaise with external search and rescue responders – Land SAR, Police SAR • Assemble and equip mine rescuers for exploration search and rescue • Gain information from aviation contractor

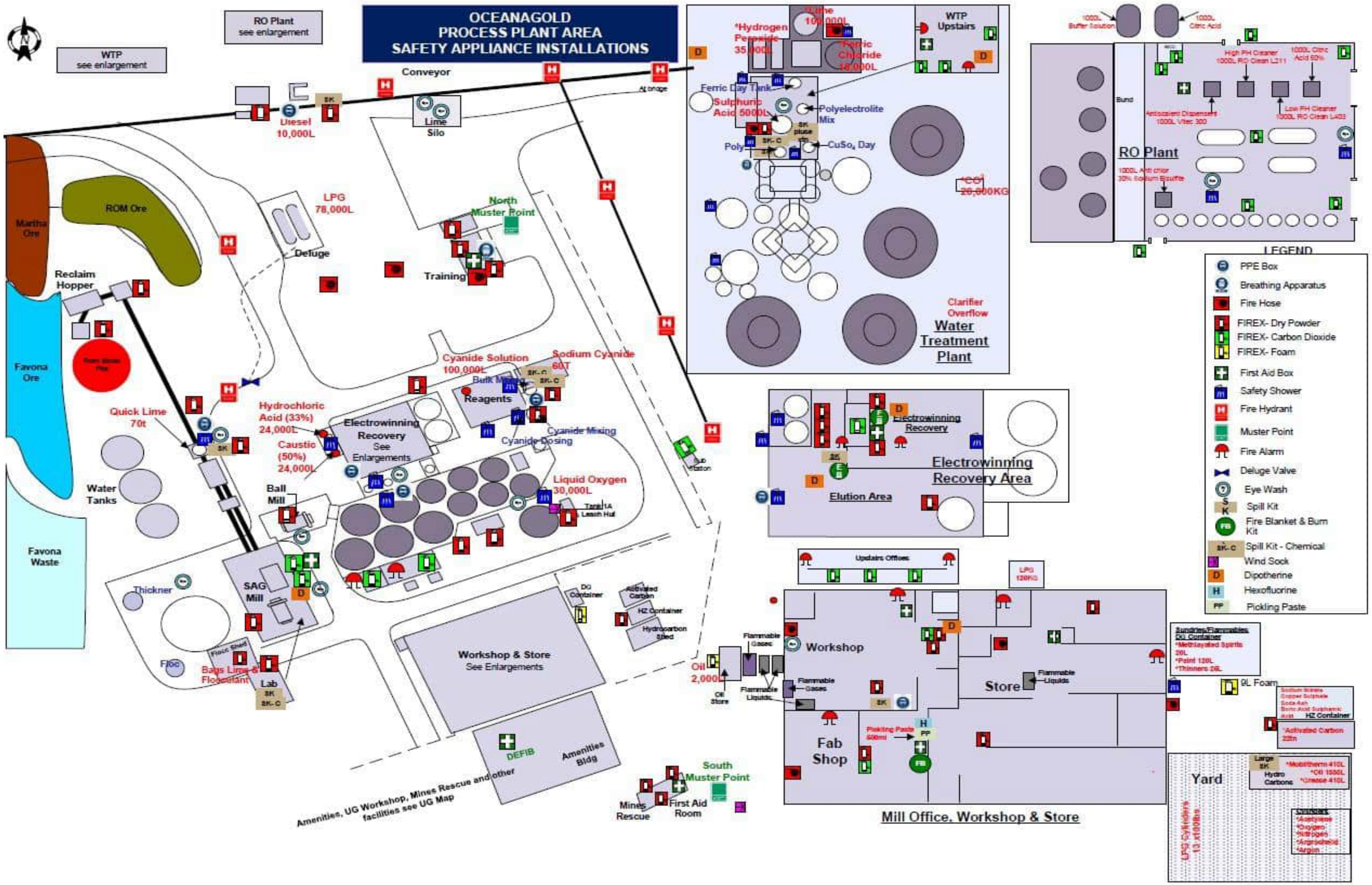
	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• No action required	• Monitor situation and maintain contact with reporting person. • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) Notify WorkSafe when appropriate	• Activate and Coordinate the Mines Rescue Team • Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate incident management team (IMT) • Notify WorkSafe when appropriate
General Manager and/or SSE	• No action required	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated Notify chief operating officer if required • Notify WorkSafe when appropriate	• Monitor situation and maintain contact with reporting person. • Notify Chief Operating Officer • Ensure MIC and IMT are being activated Notify chief operating officer if required • Notify WorkSafe when appropriate
Chief Operating Officer	• No action required	• No action required	• Implement OceanaGold Crisis Management Plan if required.

Table 35: Security

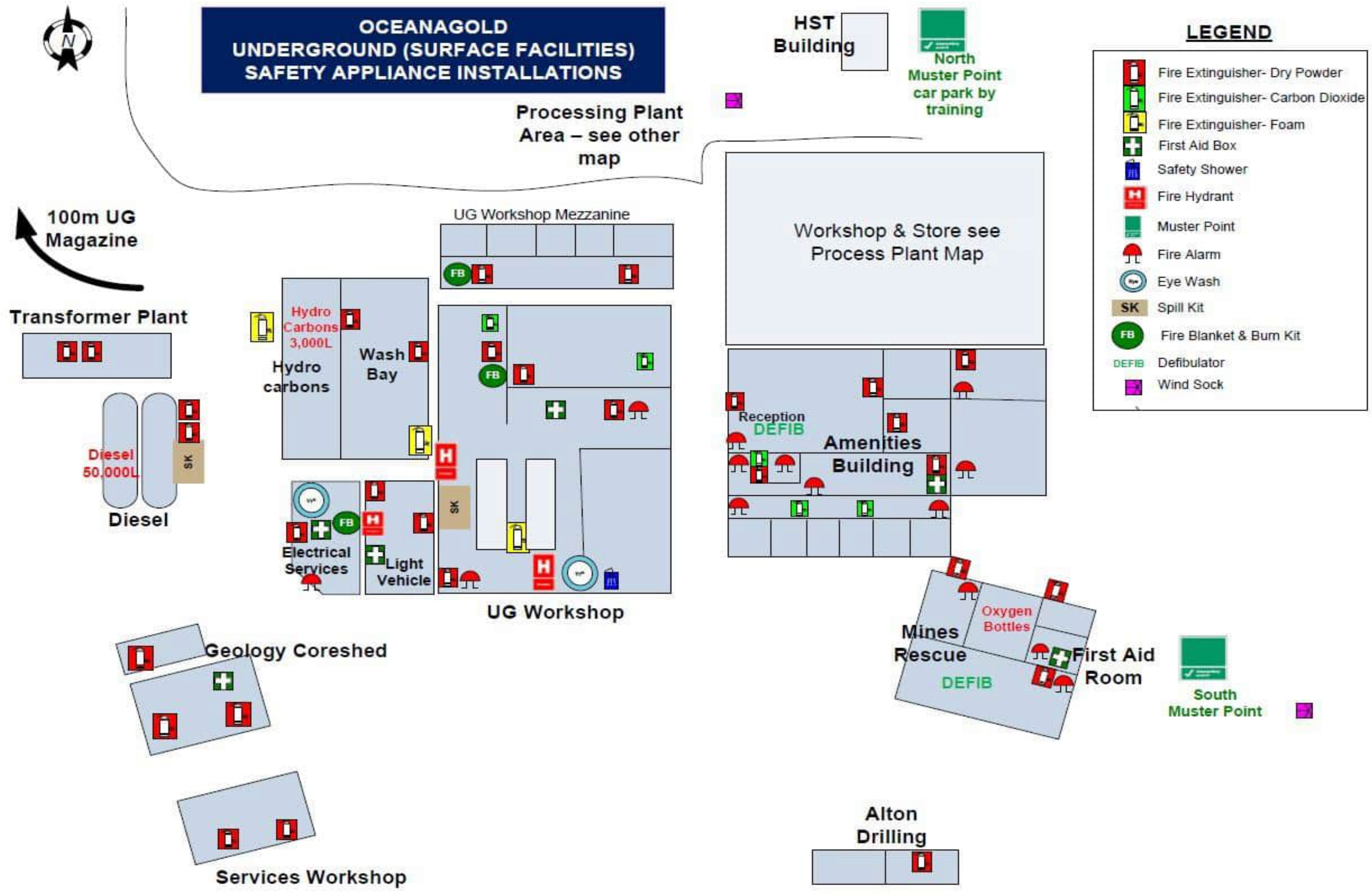
	Level 1 Response	Level 2 Response	Level 3 Response
Trigger	• An uninvited visitor of concern is on or near our operations	• An uninvited visitor of concern is on property under OGL control and will not leave when asked • An uninvited visitor is on property not controlled by OGL and will not leave when asked	• Numbers of uninvited visitors has increased Significant media exposure • Operations have ceased because of incursion.
All Personnel	• Notify Supervisor	• Quickly assess the situation and contact Supervisor Prepare to shut down equipment if required	• Quickly assess situation and notify supervisor Shut down equipment • Withdraw to a place of safety. • Inform uninvited visitors to stay clear of hazards
Emergency Call Taker	• Assess the situation and call security if required • Record and Report • Notify Department Manager if required	• Inform uninvited visitors of the hazards in the area Contact security and advise of situation • Notify Department Manager	• Inform uninvited visitors of the hazards in the area • Ensure work force is not actively engaging with visitors • Ensure workers are in a safe location Ensure area is secure • Update Security on situation and advise what other resources may be required • Update Department Manager
Supervisor	• Contact OGL Security Coordinator and OGLNZ Comms Advisor • Contact Roving Patrol if required	• Contact OGL Security Coordinator and OGLNZ Comms Advisor • Contact Roving Patrol if required	• Contact OGL Security Coordinator and OGLNZ Comms Advisor • Contact Roving Patrol if required
Emergency Response Coordinator	• Monitor situation and gather intelligence if required. • Update Dept Manager	• Supply intelligence to Department manager Contact Police if necessary • Contact EASP representative/OGLNZ Comms Advisor	• Supply intelligence to IMT Liaise with Police • Provide Situation Reports to IMT

	Level 1 Response	Level 2 Response	Level 3 Response
Department Manager (Mine Incident Controller)	• Monitor situation and update GM/SSE if required. • Make decision on trespass and communicate to stakeholders.	• Monitor situation and maintain contact with OGL • Security Coordinator • Contact Police, if necessary, advise on trespass requirements • Notify General Manager and/or SSE • Set up incident control point (ICP) Act as MIC until GM or SSE arrive • Activate incident management team (IMT)	• Notify General Manager and/or SSE • Set up incident control point (ICP) • Activate Incident Management Team (IMT) • Act as MIC until GM or SSE arrive • Advise on trespass or other legal options
General Manager and/or SSE	• No action required	• Notify Chief Operating Officer if required • Ensure MIC and IMT are being activated	• Monitor situation and maintain contact with OGL Security Coordinator Notify Chief Operating Officer • Ensure MIC and IMT are being activated • Notify chief operating officer if required
Chief Operating Officer	• No action required	• Monitor situation • Contact Corporate Communications Officer	• Implement OceanaGold Crisis Management Plan

24.16 Appendix Q Process Plant Safety Appliance Area Map



24.17 Appendix R UG Safety Appliance Area Map



24.18 Appendix S Security Duty Cards

Table 36: Security Guard – Record Emergency Call

1	**OPEN EMERGENCY PLAN AND SHUT THE GATE**					
2	**ASK THE CALLER THE FOLLOWING**					
Callers Name			**Time of Call**			
Exact Nature of the Emergency						
Exact Location of the Emergency						
3	**IS THIS AN UNDERGROUND FIRE?**	**Yes** ☐ **Go to Step 4b**		**No** ☐ **Continue**		
Are there any persons reported missing or injured?						
Does the area need to be evacuated? *(See step 4)*		**Mill**	**Yes**		**No**	
		Underground	**Yes**		**No**	
		Development Site	**Yes**		**No**	
		Pit	**Yes**		**No**	
		Moresby Ave Office	**Yes**		**No**	
Callers Contact Details:						
DO NOT HANG UP THE PHONE UNTIL ALL INFORMATION IS RELAYED						
REPEAT THE INFORMATION RECEIVED & CONFIRM CORRECT						
4	**EVACUATE PERSONNEL - IF REQUESTED**					
a) Mill	**CH 1** "Mill control, this is Baxter Rd Security - sound the evacuation siren"	☐				
b) Underground	**CH 1** "Mill control, this is Baxter Rd Security – release the underground stench gas" "Underground personnel make your way to the nearest refuge chamber"	☐				
c) Open Pit	**CH 1** "Open pit personnel this is Security – Evacuate to muster points" Push the Pit Evacuation button – at Grey St Security gate.	☐				
d) Development	**CH 9** "Development site personnel this is Baxter Rd Security: Evacuate to muster points"	☐				

e) Moresby Ave	Inform caller to sound manual call point and evacuate. Go to step 6.	☐
f) Exploration	Inform caller to maintain their own safety. Go to step 6.	☐
5	**RADIO – CHANNEL 1**	
	CH 1 "Can all mine site personnel switch to channel 1 please"	☐
	CH 1 "Emergency, Emergency, Emergency… ***there is a…………………… at the………………"***	☐
6	**ALERT MINES RESCUE** – NOTE: Mines Rescue MUST be called for all emergencies	
	Contact Mines Rescue – Inform of emergency details and any missing persons/injuries. Ask if they require Fire Brigade, St John, Police etc.	☐
	If instructed, send eTXT to Mines Rescue Team Group **Pager_1**	☐
	If instructed, send eTXT to Underground Emergency Contacts Group **Pager_6**	☐
	If instructed, send eTXT to Surface Emergency Contacts Group **Pager_7**	☐
7	**CALL EMERGENCY SERVICES 111**	

Ambulance / Fire	Time:		☐

OTHER				
8	Close Gate – only allow site access for escorted emergency services, mines rescue or the management team. Contact roving patrol to assist at gate			☐
9	Issue warden vest to assist with traffic at the gate – if required			☐
10	Issue vest for Emergency Services Escort - if required			☐
11	Print CARDAX Emergency Muster Report – give to escort			☐
12	Inform Chief Warden on CH 1 of CARDAX numbers onsite			☐
13	Surface Evacuation	Chief Warden name:		☐
	UG Evacuation	Tag Board Controller name:		☐
14	Contact Safe & Sound Supervisor			☐
15	Notify Senior Personnel – (next page)			☐
16	If you need further assistance, contact your supervisor, Site Services Coordinator, or the Chief Muster Warden/Tag Board Controller.			☐

24.19 Area Contacts

1. Area Contacts – contact personnel in the location of the emergency			
2. Site Management - Contact for every emergency			
MILL	**Name**	**Mobile**	**Time**
Processing Manager	Thomas Trott	027 205 7286	
Processing Specialist	Brett Twidle	021 286 0478	
Superintendent Maintenance	Scott Davison	021 484 987	
Senior H&S Advisor	Peter Lowe	021 856 918	
OPEN PIT	**Name**	**Mobile**	**Time**
Principal Geotech Engineer	Andre Alipate	027 242 0393	
Site Services Co-Ordinator	Shay Perkinson	021 549 933	
Senior H&S Advisor	Peter Lowe	021 856 918	
DEVELOPMENT SITE	**Name**	**Mobile**	**Time**
Site Services Co-Ordinator	Shay Perkinson	021 549 933	
Senior H&S Advisor	Peter Lowe	021 856 918	
UNDERGROUND MINING	**Name**	**Mobile**	**Time**
Underground Manager	David Townsend	027 490 4864	
Underground Superintendent	Nick Hewlett	021 0241 9554	
Tech Services Superintendent	Patrick Slagter	022 139 9677	
Electrical Superintendent	James Rutledge	027 504 3551	
UG Maintenance Superintendent	Lindsey Heaton	027 250 7706	
Senior H&S Advisor	Craig Surtees	027 734 0317	
EXPLORATION	**Name**	**Mobile**	**Time**
Exploration Manager	Lorrance Torckler	021 190 2996	
Principal Geologist	Leroy Crawford-Flett	027 460 7214	
Exploration Supervisor	Caroline Steward	021 279 9739	
Alton Surface Project Leader	Aaron Warn	021 722 584	
Alton Drilling – Ops Manager	Fabian Harley	027 531 0089	
Alton Drilling – H&S Manager	Glen Grindlay	021 190 2439	
Alton UG Project Leader	Kevin Peka	027 801 0555	
Senior H&S Advisor	Peter Lowe	021 856 918	
SITE MANAGEMENT	**Name**	**Mobile**	**Time**
General Manager	Justin Johns	027 3946477	
SSE	David Townsend	027 490 4864	
HST Manager	Dave Oliver	021 202 7855	
Security Guard Involved			
Date			
Time of Incident completion			
Signed			

ACTIVITY LOG	TIME

24.20 Appendix T Site Specific Evacuation Duty Cards

Site specific duty cards for:

- Underground mining
- Processing
- Exploration
- Open Pit
- Development site
- Moresby Ave Office
- Education Centre

Are available in:

- EMPCP Duty Cards – WAI-251-PRO-011
- Tagboard Controller Duty Card
- Moresby Ave Evacuation Plan – WAI-250_PRO-002
- Education Centre Evacuation Guideline – WAI-800-GUI-001

24.21 Appendix U – Legislation Compliance Checklist

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
Part 5 Principal Control Plans – Subpart 4 Emergency Management	
104 Consultation with emergency services -	
(1) When developing an emergency management control plan for an operation, the responsible person must consult—	
(a) the fire, police, and ambulance emergency services that have responsibility for the area in which the operation is located; and	Sections 2, 5, 10.3, 16
(b) in the case of a coal mining operation, an underground metalliferous mining operation, or a tunnelling operation where a tunnel is intended to be 150 metres or more in length, the Mines Rescue Trust Board.	Sections 2, 5, 10.3, 16
105 Emergency management control Plan	
(1) The emergency management control plan must, at a minimum, address the following matters	
(a) the co-ordination and control of emergencies at the mining operation:	Section 1, 9, 13
(b) the people or positions at the mining operation who have, or that will have, responsibilities in relation to emergencies at the mining operation, and the details of those responsibilities:	Section 13
(c) the events that trigger the activation of the plan:	Sections 4.1, 8 and Appendix P
(d) the use of communication systems in emergencies at the mining operation:	Section 8, 10
(e) the giving of timely notice, information, and warnings about emergencies to anyone potentially affected by an emergency at the mining operation, including to the persons nominated as next of kin by mine workers:	Section 10, 11, 8.2
(f) measures to be taken to isolate an area of the mining operation affected by an emergency:	Section 11
(g) the availability of the Mines Rescue Trust and other emergency services to respond to an emergency at the mining operation:	Section 15

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
(h) the means to locate and account for people at the mining operation in the event of an emergency at the mining operation:	Section 11.1.9
(i) the maintenance of an accurate record of all people underground at a mining operation at all times and their likely location, and the availability of that record for the purposes of responding to emergencies at the mining operation:	Sections 12
(j) the evacuation of the mining operation in an emergency, including the conditions that will prompt withdrawal of mine workers from the mining operation where there is an imminent risk of injury or illness to mine workers:	Sections 8, 9, 11
(k) appropriate transportation from the mining operation:	Section 15
(l) first-aid arrangements at the mining operation, including first-aid equipment, facilities, and services and the mine workers who are qualified to provide first aid:	Section 15
(m) provision for all aspects of firefighting, including adequate and compatible firefighting equipment, procedures for firefighting, and training mine workers in firefighting:	Section 15
(n) a procedure to ensure prompt notification of all relevant emergency services and the Mines Rescue Trust	Section 16
(2) In the case of an underground mining operation or tunnelling operation, the emergency management control plan must, in addition to the matters in subclause (1), include provision for ensuring—	
(a) there is an effective means of communicating between the surface of the mining operation and any part of the mining operation where people may be located underground; and	Section 10

HEALTH AND SAFETY AT WORK (MINING OPERATIONS AND QUARRYING OPERATIONS) - REGULATIONS 2016	SITE DOCUMENT REFERENCE
(b) the availability of a suitable number of people trained in mines rescue who will be able to respond to an emergency at a mining operation; and	Section 16.1.12
(c) there is adequately maintained equipment at the mining operation that will— i. allow for rapid and continuous rescue operations to take place at the mining operation in conditions of reduced visibility and irrespirable and irritant atmospheres; and ii. assist the escape or safe recovery of any mine worker or other person from a mining operation where necessary; and	Section 12, 15
(d) the safe escape of people from underground in the mining operation through conditions of reduced visibility and irrespirable and irritant atmospheres (including adequately maintained self-rescuers and other facilities to aid escape where appropriate); and	Section 12, Appendix F
(e) there is an appropriate means of escape to the surface part of the mining operation; and	Section 11.1.5 Appendix F
(f) the maintenance of an up-to-date plan of— i. the exits from the underground parts of the mining operation; and ii. the changeover stations and refuges in the underground parts of the mining operation	Section 12 Appendix F

106 Testing, etc, of emergency management control plan	
(1) In addition to the requirements of regulation 94, the site senior executive must ensure that—	
(a) the emergency management control plan is regularly tested— i. using practice drills; and ii. involving the emergency services referred to in regulation 104; and	Sections 12, 14, 16.1.10, 17
(b) mine workers are provided with training in the emergency management control plan and that the provision of this training is recorded.	Section 17
(2) The mine operator must ensure that the mining operation is provided with adequate resources to—	
(a) effectively implement the emergency management control plan; and	Sections 4.1.3, 13
(b) keep facilities and equipment regularly inspected and maintained in a fully operational condition.	Section 15
(3) In addition to the requirements of regulation 62, the site senior executive must ensure that a copy of the current emergency management control plan is given to the Mines Rescue Trust, where relevant, and other emergency services referred to in regulation 104.	Distribution of copies

Part 8 Specific duties in underground mining operations and tunnelling operations – Emergency	
166 Competent persons at surface when mine workers underground	Section 17
167 Emergency Contact Details	Section 12
168 Self-rescuers	Section 12
169 Training in use of self-rescuers	Section 12
171 Escapeways in underground metalliferous mining operations and tunnelling operations	Section 12
172 Additional requirements for escapeways in underground metalliferous mining operations	Section 12
173 Changeover stations and refuges	Section 12
174 Navigational aids	Section 12
175 Communications systems	Section 10

Appendix G Hazardous Facilities Screening Assessment

OPERATOR		OceanaGold (New Zealand) Limited																		
PROJECT		Willows Road portal entrance site - Surface storage only																		
LOCATION		Willows Road, Waihi																		
Ref. No.	**Substances on this site**	**CAS No.**	**Effect Type**	**Hazard Rating**	**Base Quantity B t or m³**	**Substance Form**	**Distance to boundary less than 30 metres? YES NO**	**Adjacent to water? YES NO**	**Type of Activity A/Above B/Under-ground Use**	**Adjustment Factors F1**	**F2**	**F3**	**Product of Adjustment Factors**	**Adjusted Quantity A**	**Specific gravity**	**Volume (L)**	**Proposed Quantity P t or m³**	**Fire/ Explosion Effect Ratio**	**Human Health Effect Ratio**	**Environment Effect Ratio**
1	Diesel	68334-30-5	Fire/Explosion	Low	100	Liquid	n		a	1.0	3.0	1.0	3	300	0.85	80700	68.6	0.23		
			Human Health	Low	30					1.0	1.0	1.0	1	30					2.29	
			Environment	Medium	30			n		1.0	1.0	1.0	1	30						2.29
2	Booster/ANFO/ Packaged explosive	118-96-7	Fire/Explosion	High	0.1	Powder	n		a	1.0	3.0	1.0	3	0.3			7.4	24.50		
			Human Health	Medium	10					1.0	1.0	1.0	1	10					0.74	
			Environment	Medium	30			n		1.0	1.0	1.0	1	30						0.25
3	Initiating explosive/detonators	78-11-5	Fire/Explosion	High	0.1	Solid	n		a	1.0	3.0	1.0	3	0.3			0.01	0.03		
		7758-97-6	Human Health	-	-															
		13424-46-9	Environment	-	-			n												
4	Ammonium nitrate emulsion	6484-52-2	Fire/Explosion	High	1	Liquid	n		a	1.0	3.0	1.0	3	3			40.8	13.60		
			Human Health	-	-															
			Environment	low	100			n		1.0	1.0	1.0	1	100						0.41
5	Gasser	7632-00-0	Fire/Explosion		-	Liquid	n		a								8.0			
			Human Health	Low	30					1.0	1.0	1.0	1	30					0.27	
			Environment	Low	100			n		1.0	1.0	1.0	1	100						0.08
6	Oxygen	7782-44-7	Fire/Explosion	High	10000	Gas	n		a	0.1	3.0	1.0	0.3	3000			60.0	0.02		
			Human Health																	
			Environment					n												
7	Acetylene	74-86-2	Fire/Explosion	High	10000	Gas	n		a	0.1	3.0	1.0	0.3	3000			20.0	0.01		
			Human Health																	
			Environment					n												
	Total Effects Ratios																	**38.4**	**3.3**	**3.0**

Appendix H Air Quality Assessment

REPORT

Tonkin+Taylor

This document has been produced for New Zealand consenting purposes only. Information contained herein must not be relied on for investment purposes.

Wharekirauponga Underground Mine – unplanned detonation air quality assessment

Prepared for

Oceana Gold (New Zealand) Limited

Prepared by

Tonkin & Taylor Ltd

Date

June 2022

Job Number

1015212.2000 vRev0

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Document control

Title: Wharekirauponga Underground Mine – unplanned detonation air quality assessment					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
June 2022	Rev0	Wharekirauponga Underground Mine – unplanned detonation air quality assessment	R Turnwald	R Chilton	J Simpson

Distribution:

Oceana Gold (New Zealand) Limited	1 electronic copy
Tonkin & Taylor Ltd (FILE)	1 electronic copy

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1 Introduction

1.1 Overview

Oceana Gold (New Zealand) Limited (OGNZL) is seeking resource consent from the Hauraki District Council (HDC) and Waikato Regional Council (WRC) for the activities required to establish a new mining operation in the Wharekirauponga Valley. This new mine, referred to as the 'Wharekirauponga Underground Mine' (WUG), is part of the Waihi North Project (WNP) to extend the life of mining activities in Waihi. As part of development of the WUG, OGNZL propose to establish a new underground Class 1 explosives storage facility to supply the mining operation. The new store will contain up to 6,100 kg of Class 1 explosives 380 m below the surface in mine space below the Conservation (Indigenous Forest) Zone under the Hauraki District Plan (HDP).

This activity has been assessed in a hazardous substances risk assessment, which was provided by Mitchell Daysh to the HDC as a draft for review in late 2021. On 17 January 2022, the HDC issued letter detailing its initial review comments[1], which included a query about the potential for rapid release of explosion gases at the vent shafts in the event of an unintended detonation in the underground store.

Reaction gases produced during the detonation of explosives principally consist of carbon dioxide (CO_2), nitrogen (N_2) and water vapour. However, other gases may also be formed, such as carbon monoxide (CO) and oxides of nitrogen (NO_X), the latter including nitrogen dioxide (NO_2) which is a respiratory irritant at sufficiently high concentrations. The resultant concentration of these contaminants in ambient air beyond the site can be evaluated using dispersion modelling analysis and comparison with national standards and guidelines for ambient air quality.

Tonkin & Taylor Limited (T+T) has been engaged by OGNZL to prepare this air quality assessment to support resource consent applications being prepared by OGNZL. This report has been prepared in accordance with our variation order dated 5 November 2021.

1.2 Purpose and scope

This study has been prepared to evaluate the impact of an unplanned detonation in the proposed underground explosives store on ambient air quality in the vicinity of the surface connections.

The following reports and their shorthand are referred to throughout:

- *WKP UG Magazine Explosion – Gas Dispersal Study*. Entech Limited, February 2022 attached as Appendix A. This report is referred to throughout as the 'Gas Dispersal Study'.
- *Hazardous substance technical assessment – Waihi North Project –Storage and use of hazardous substances at Willows Road site and the Wharekirauponga Underground Mine*. Tonkin & Taylor Limited, June 2022. Referred to as the 'HSA'.

1.3 Associated reports

This report is part of a larger application, and specifically addresses the human health risk of contaminants released from a detonation in the underground store in the WUG. Assessment of other risks associated with the WNP are provided in the following documents:

- *Waihi North Project - Resource Consent Applications and Assessment of Environmental Effects*, Mitchell Daysh Limited, June 2022.

[1] Resource Consulting Limited. RELEVANT MATTERS IN SUPPORTING DRAFT REPORTS FOR LAND USE CONSENT APPLICATION FOR WAIHI NORTH PROPOSAL WITH REGARD TO HAZARDOUS SUBSTANCE RISKS. 17 January 2022.

2 Environmental setting

2.1 Site location

In the event of an unintended detonation in the underground explosives storage facility, the overpressure will propagate through the mine space and be expelled at the surface connections, which include the access portals, fresh air rises (FAR) and return air rises (RAR). The surface connection configuration is illustrated in Figure 2.1 below, which does not picture Site 1 (the access portal in Waihi) which is over 10 km from the underground Class 1 store. These surface connections are the key sites at which there is potential for effects to people due to discharges to air in the event of an unintended detonation at the storage facility.

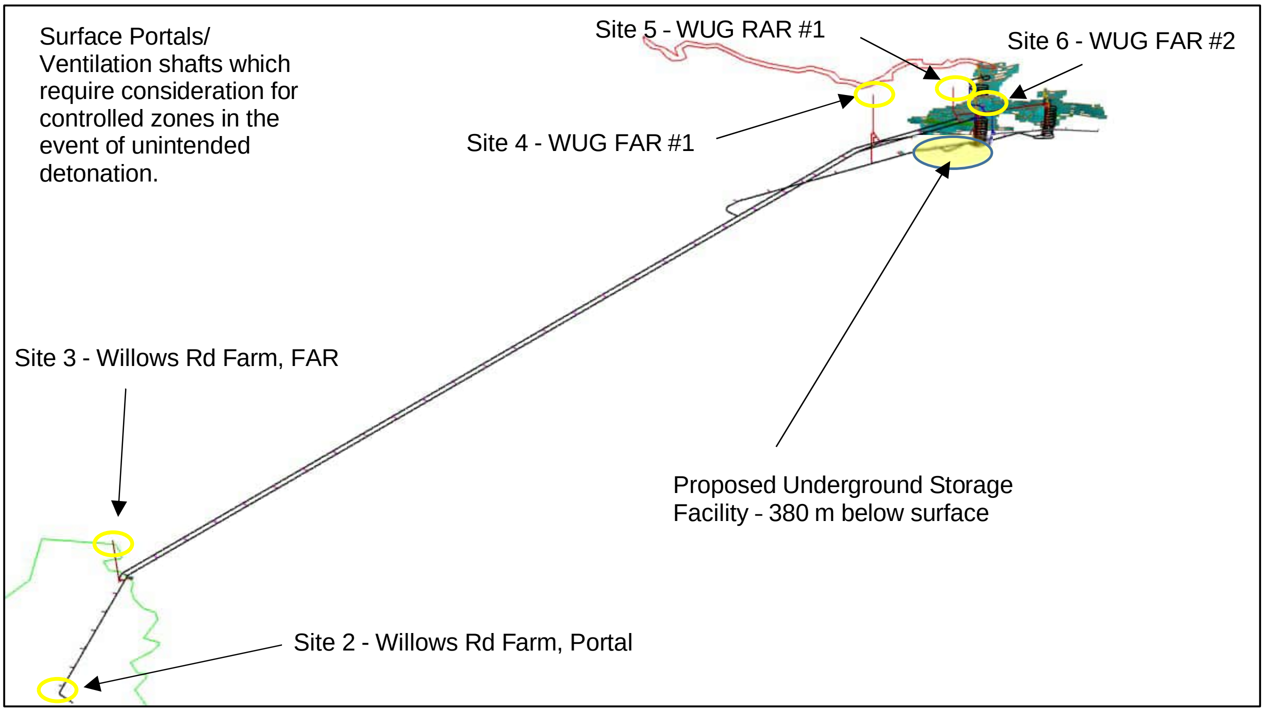

Figure 2.1: Underground storage facility location in relation to surface connections (Site 1 in Waihi not pictured) (source: GSS, 2021)

A description of each surface connection location, including the zoning under the HDP and public accessibility are detailed in Table 2.1 below.

Table 2.1: Description of surface connections (adapted from GSS, 2021)

Site ID[2]	Zone	Description	Shortest path to WUG magazine
Site 1 – Waihi Portal	Martha Mineral	The portal for receipt of the ore for processing at the nearby processing plant. This is within OGNZL's industrial site and is not accessible to the public.	Approximately 10 km southeast of the WUG.
Site 2 – Willows Portal	Rural	The main access portal to the mine consists of a large horizontal type decline that is used as the main entry/ exit route. To the WUG	Approximately 7 km southeast of the WUG.
Site 3 – Willows Rd Farm Fresh Air Intake	Rural	This fresh air intake connection is location within OGNZL owned land at the northern end of the Willows Road site.	Approximately 6 km from the WUG.
Site 4 – WUG Rise #1	Conservation (Indigenous Forest)	The three WUG Rise connections are located within the HDC paper road boundary in a remote forested area. This road is not maintained as a public walkway. However, each proposed location will consist of a 10 m x 10 m area with a perimeter fence restricting access to members of the public. The nearest public walkway terminates at a swing bridge approximately 1 km from the northernmost vent. Rise #1 and Rise #3 are fresh air intakes, only Rise #2 will exhaust air when the mine's ventilation system is operational.	Approximately 0.9 km from the WUG Class 1 store.
Site 5 – WUG Rise #2	Conservation (Indigenous Forest)		Approximately 0.6 km from the WUG Class 1 store.
Site 6 – WUG Rise #3	Conservation (Indigenous Forest)		Approximately 0.7 km from the WUG Class 1 store.

2.2 Site surroundings and sensitivity

Two of the surface connections are on OGNZL owned land at Willows Road, and three are located within the Coromandel Forest Park along a paper road. These three are closest to the underground store and are expected to be at the highest risk of impacts from discharges to air from the mine.

The surface connections in the Coromandel Forest Park are all either air exhausts or intakes, an example of which is included as Figure 2.2 below. The location of each surface connection will be securely fenced off (typical dimensions 10 m x 10 m square) to exclude members of the public from close proximity to the shaft.

[2] Site numbering differs from those provided in the location assessment prepared by GSS in 2021, as the Waihi Portal has been included as Site 1.

Figure 2.2: Typical return air rise (exhaust) vent *Source: OGNZL*

There is an old walkway along the paper road (shown south of the WUG on Figure 2.3) within the forest area. However, this path is not maintained as a public walkway and therefore not typically used by members of the general public.

The Wharekirauponga Track is a public walking track maintained by the Department of Conservation (DOC). It currently terminates at a swing bridge approximately 1 km north of the closest vent (Site 6). In future the loop past the bridge (shown in pink Figure 2.3) could be reinstated, which would make the closest point on the walkway 400 m north of the vent.

While unlikely, there is potential for a person to be in the vicinity of a vent in an accidental detonation. This exposure scenario is considered by dispersion modelling of contaminants released at this location.

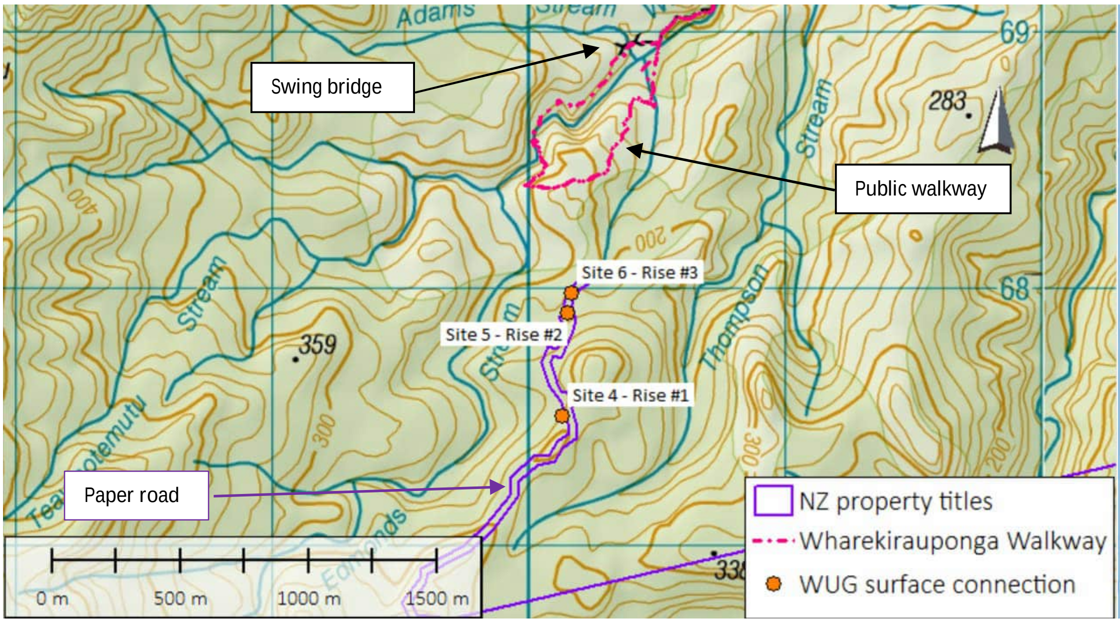

Figure 2.3: Surface connection locations closest to the WUG Class 1 underground store
Image source: Property Boundary, Topography maps and walking track information from the LINZ Data Service

2.3 Existing air quality

The only anthropogenic air emission sources within this the Coromandel Forest Park are the exploratory drilling activities undertaken by OGNZL, which will represent very minor combustion product sources in the otherwise pristine area.

Although there is no ambient monitoring data available, the air quality at this location is expected to be very high quality, consistent with rural locations with few sources of industrial, transport or domestic air emissions.

Other surface connections at Willows Road and Waihi are a significant distance from the potential source of the detonation and air quality at these locations is not expected to be impacted.

3 Description of activity and nature of discharges

3.1 Description of explosives storage

The proposed underground Class 1 explosives storage facility is to be situated 380 m below the surface, with six separate chambers each holding up to 1,000 kg Net Explosive Quantity (NEQ) of high explosives as detailed in Section 2.2.2 of the HSA. A seventh chamber is dedicated to initiating explosives, containing up to 100,000 units (or 100 kg NEQ).

The proposed layout of the storage facility is shown in Figure 3.1 below.

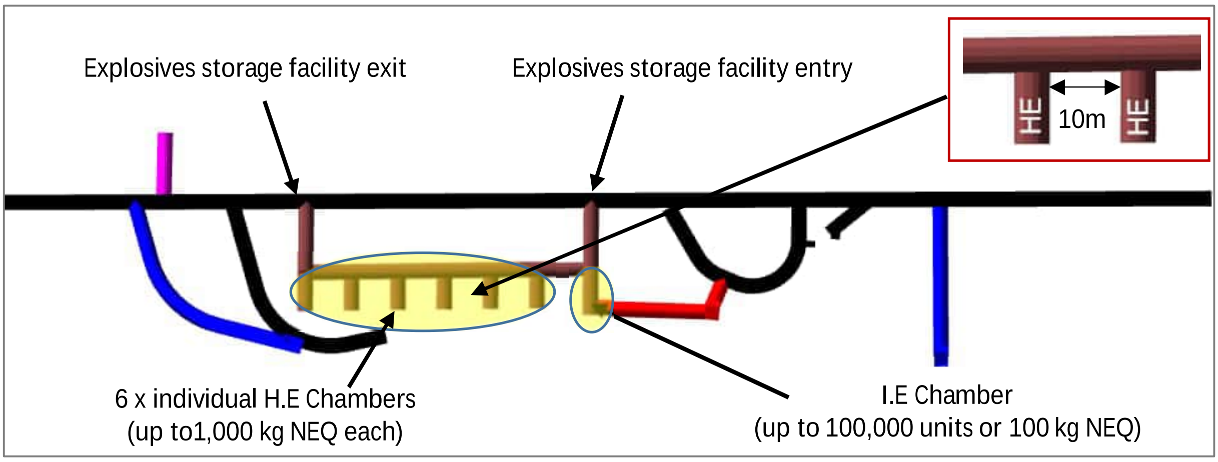

Figure 3.1: Magazine chamber layout including separation distances and proposed stored quantities'
Source: GSS 2021

The separation distances between the different explosive types have been compared by GSS with those established in accordance with Annex M of the *International Ammunition Technical Guideline, Quantity and separation distances* published by the United Nations Office for Disarmament Affairs (UNODA) in 2015. OGNZL advises that the separation distance between the chambers containing 1,000 kg of Class 1 explosive meet the calculated minimum at which blast propagation between chambers is unlikely.

3.2 Nature of discharges

The mine ventilation modelling software package Ventsim has been run by Entech and provides gas yields for detonation of Ammonium Nitrate Fuel Oil (ANFO). Ventsim identifies the following hazardous gases as the main products of combustion:

- Carbon monoxide (CO), which is a poisonous and flammable gas.

- Oxides of nitrogen (NO_X), primarily comprised of nitrogen oxide (NO) and nitrogen dioxide (NO_2). NO_2 is visible as a brown gas and is a respiratory irritant.
- Ammonia (NH_3), a flammable and corrosive gas.

3.2.1 Emission scenarios

In the event of an unintended detonation, the overpressure would propagate through the mine space and be expelled at the surface connections identified in Section 2.1. These locations are the key sites at which there is potential for effects on off-site people or property in the event of an unintended detonation at the storage facility.

The gas dispersal report prepared by Entech attached as Appendix A describes three emission scenarios, summarised as follows:

1. No damage to mine ventilation systems, mechanical ventilation of explosion gases resulting in emissions from Rise #2 (Site 5)
2. Failure of the mine ventilation systems due to damage from the explosion. Two natural ventilation scenarios are possible due to the different seasonal conditions resulting in emissions either to Rise #1 (Site 4) or the access portals at Willows Road and Waihi (Sites 1 and 2). In the natural ventilated scenarios, the following is airflow restrictions will apply:
   a. Damper doors on primary fans prevent the reversal of airflow when fans are switched off.
   b. Damper doors will not open under natural ventilation pressure.

Ventsim modelling was carried out for the scenarios listed above by Entech. From this, the scenario in which the mine's mechanical ventilation continues to function provides the greatest volumetric flowrate and the highest concentration of contaminants and releases the contaminants over the shortest timeframe. Consequently, Scenario 1 is considered the most conservative for the purposes of this assessment.

The emission profile for the mechanically ventilated scenario (Scenario 1) was predicated on the following conservative assumptions that were made by Entech:

- there is a sufficient ignition source within one of the chambers to create an explosion.
- the chamber contains its maximum licenced capacity of explosives (1,000 kg NEQ).
- 100% of the product will combust instantaneously (this is considered unlikely due to the low packing density of the storage chamber compared with a blasthole).

Entech advises that this scenario will produce a higher concentration of gaseous contaminants at the vent stack than would be anticipated in reality.

A summary of the parameters that apply to each scenario is provided in Table 3.1.

Table 3.1: Emission parameters for the different ventilation scenarios

	Mechanical ventilation	Natural ventilation			
	All seasons	Summer			Winter
	Fan on	1. Fan off	2. Fan off		Fan off
Parameter	Site 5 – Rise #2	Site 4 – Rise #1	Site 1 - Plant Portal	Site 2 – Willows Portal	Site 4 – Rise #1
Temperature (ºC)	21.4	21.8	22.9	22.3	14.7
Pressure (hPa)	971	966	985	975	965
Velocity (m/s)	16.4	0.9	0.4	0.4	0.5
Volumetric flowrate (m^3/s)	387	17.4	9.5	10.6	10.6
Duration of release	15 minutes 40 seconds	13 hours 18 minutes	20 hours 7 minutes	20 hours 11 minutes	2 days 21 hours

3.3 Discharge location and parameters

3.3.1 Stack discharge parameters

The physical parameters of the vent discharges from the Site 5 (Rise #2) vent for Scenario 1 are summarised in Table 3.2. The derivation of the parameters is based on the following:

- Physical stack dimensions provided by OGNZL.
- Mine ventilation simulation provided by Entech.

Table 3.2: Summary of modelled vent discharge parameters

Stack ID	Stack name	Stack height (m)	Stack orientation	Exit diameter (m)	Vent exhaust flowrate (m^3/s)	Vent exit velocity (m/s)	Exit temperature (°C/°K)
Site 5	Rise #2	7.8	Vertical	5.5	387	16.3	21.4 / 294.4

3.3.2 Emission rates

The emission profile for the mechanically ventilated scenario shows that all the contaminants are exhausted from the return air rise (Site 5) in under 20 minutes from the detonation. This will provide the highest concentration of contaminants in the gas stream.

The modelled emission rates for the mechanically ventilated scenario are provided in Table 3.3 below. These rates were determined in accordance with the calculations set out in Appendix B.

Table 3.3: Modelled emission rate

Source ID	Source name	CO (g/s)	NO_X (g/s)	NH_3 (g/s)
Site 5	Rise #2	35.2	4.6	1.5

While some of the oxides of nitrogen produced in the detonation are expected to be emitted as nitric oxide, for the purpose of a conservative screening assessment it has been assumed that all NO_X is released as NO_2 from the source.

4 Air dispersion modelling approach

4.1 Introduction

Air dispersion modelling is the mathematical simulation of how air contaminants emitted from a source disperse in the ambient atmosphere. The outputs from the dispersion model are the predicted ground level concentrations (GLCs) of air contaminants from the modelled sources, which can be calculated for different averaging periods to align with the relevant assessment criteria.

The objective of the dispersion modelling is to assess the potential effects of air discharges of contaminants from the site by comparing the predicted GLCs (and added to background concentrations where relevant) against assessment criteria.

Dispersion modelling has been undertaken using the most recent (non-beta) version of the CALPUFF air dispersion model (version 7.2.1). CALPUFF is an advanced dispersion model that is widely used in New Zealand, especially in areas of complex terrain as presented at this location.

In accordance with the Good Practice Guide for Atmospheric Dispersion Modelling[3] (GPG Modelling), the 99.9th percentile is reported for 1 hour averaging periods.

4.2 Modelled receptor locations

The CALPUFF model was configured to predict GLCs for four nested receptor grids of increasing spatial resolution (Table 4.1) centred on Site 5 (Rise #2). The nested receptor grid approach provides a high level of resolution close to the discharge source where the magnitude and spatial variation in impacts is typically greatest, with decreasing resolution in grid spacing further afield. The receptor grid is shown on Figure 4.1.

Table 4.1: Nested receptor grids

Distance from centre (m)	Receptor spacing (m)
0 – 200	25
200 – 400	50
400 – 600	100
600 – 2200	200

The area around Site 5 (Rise #2) is within the State Forest land administered by DOC. It is part of a large area of secondary indigenous forest and scrub that forms the Coromandel Forest Park. As discussed in Section 2.2, a partially closed public walking track terminates at a swing bridge located approximately 1 km north of Site 5. This track is shown in green on Figure 4.1.

[3] Ministry for the Environment. 2004. Good Practice Guide for Atmospheric Dispersion Modelling. Wellington: Ministry for the Environment.

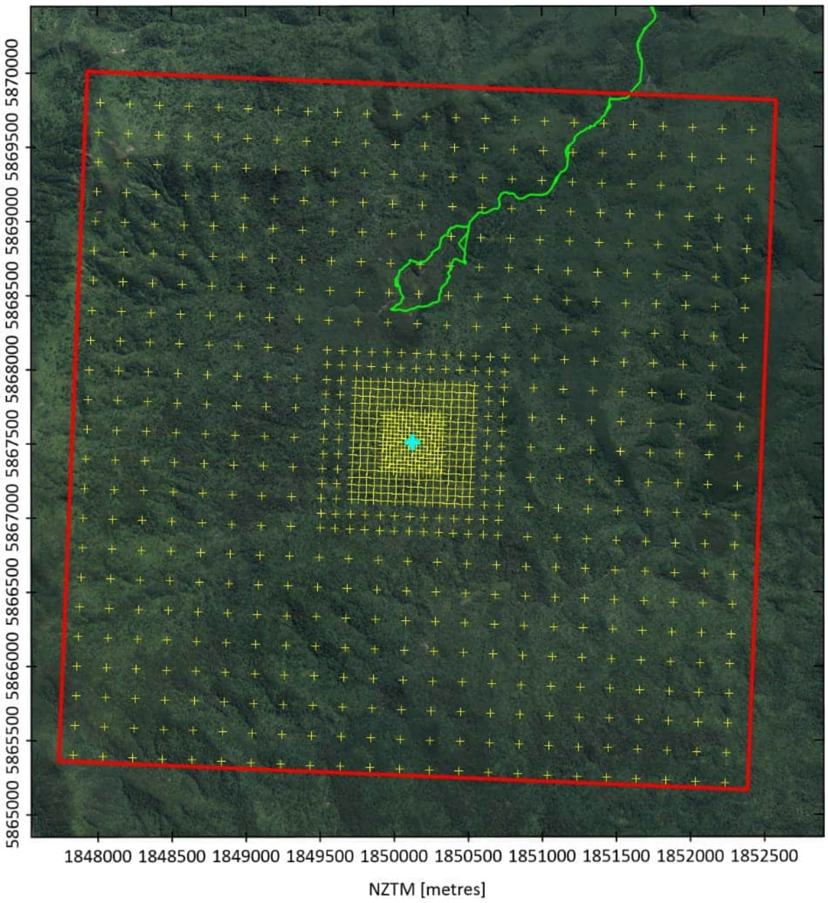

Figure 4.1: Location of modelled nested receptor grids (yellow crosses). The red square represents the edge of the computational grid and the green line illustrates the Wharekirauponga Valley walking track

4.3 Model meteorology

A two-year meteorological dataset was developed by T+T using the CALMET meteorological model for the years 2016 and 2017. We note that 2016 and 2017 are expected to provide a suitable range of meteorological conditions due to those years experiencing a mix of La Niña and El Niño climatic conditions.

The model domain covered an area of 12.75 km (east to west) by 15km (north to south) at a 150 m grid resolution. Input data for the CALMET model were derived from the meteorological component of the TAPM model, as well as terrain and land use information sourced for Land Information New Zealand (LINZ). Error! Reference source not found. provides figures that illustrates the CALMET model domain and terrain inputs along with details of the configuration of both the CALMET and CALPUFF models.

4.4 Terrain

Terrain data is used both in the development of the modelling meteorological dataset (as it influences wind-flows) and in the dispersion modelling (as pollutant plumes interact with terrain).

The forested terrain rises to the nearest peaks of Pukehuru (680 m above mean sea level (ASL)) and Whakamoehau (750 m ASL) approximately 3 km southwest of Site 5. The Wharekirauponga Walking Track follows the valley alongside the Wharekirauponga Stream. The emission from the Site 5 vent shaft at a higher elevation than the stream and walkway will facilitate dilution and dispersal of contaminants and minimise the impact at the location most likely to be frequented by the public.

5 Model results

5.1 Introduction

The GLCs predicted using dispersion modelling have been used to assess the effects of contaminants by comparing predicted off-site concentrations, added to background concentrations, against relevant assessment criteria. Background concentrations of NO_2 and CO are based on published background levels for non-urban areas, detailed in Section 5.2 below.

5.2 Background concentration

Ambient background concentrations are added to the modelled GLCs to present the total ambient concentrations for each contaminant. Representative 24-hour background levels are provided for rural areas in Waka Kotahi's background air quality map[4] and Auckland Council's Use of Background Air Quality Data in Resource Consent Applications Guideline Document[5](GD 2014/01), as recommended in the GPG Industry guidance. In practice, background concentrations in the forest area will better than expected of a rural area. Accordingly, we consider that these default background concentrations are likely to significantly overstate existing air quality in a pristine forested location.

Table 5.1: Applicable background concentrations

Contaminant	Averaging period	Background concentration (µg/m^3)	Source
CO	1-hour	5,000	Auckland Council for rural areas
NO_2	1-hour	37	Waka Kotahi for rural areas

There is not expected to be an appreciable background level of NH_3 in the forest reserve.

5.3 Assessment criteria

Assessment criteria have been adopted based on the hierarchy set out in relevant Ministry for the Environment's good practice guidance (GPG Industry[6]), and include values from the National Environmental Standards for Air Quality (NESAQ) and the New Zealand Ambient Air Quality Guidelines (AAQG).

The relevant human health assessment criteria for emissions of CO, NO_2 and NH_3 are summarised in Table 5.2 below. Comparison with these concentrations is made to identify potential impacts on human health at proximity to the discharge location.

Table 5.2: Criteria for ambient air quality

Contaminant	Averaging period	Concentration (µg/m^3)	Reference
CO	1-hour	30,000	NZ AAQG

[4] Waka Kotahi. https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/air-quality-climate/planning-and-assessment/background-air-quality. Retrieved 11 April 2022.
[5] Auckland Council. 2014. Use of Background Air Quality Data in Resource Consent Applications. Auckland.
[6] Ministry for the Environment. 2016. Good Practice Guide for Assessing Discharges to Air from Industry. Wellington: Ministry for the Environment.

Contaminant	Averaging period	Concentration ($\mu g/m^3$)	Reference
NO_2	1-hour	200	NESAQ / NZ AAQG
NH_3	1-hour	21,000	US EPA AEGL

NES_{AQ} = National Environmental Standards for Air Quality
NZ AAQG = New Zealand Ambient Air Quality Guidelines
USEPA AEGL = United States Environmental Protection Agency Acute Exposure Guideline Levels

There is no specific guidance in New Zealand for evaluating the significance of modelled concentrations relative to the assessment criteria. To provide context for the model results, we have adopted the framework described in UK Institute of Air Quality Management (IAQM) guidance[7], as illustrated in Figure 5.1Error! Reference source not found..

Long term average Concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Figure 5.1: Impact descriptors for individual receptors (IAQM)

5.4 Model results

The predicted model results are illustrated as contour plots in Appendix D. The contour plots show that the highest GLCs are localised to approximately 130 m northeast of the vent stack in the forest reserve. A secondary concentrated area is approximately 860 m to the southeast of the vent.

The contours show concentrations that are significantly influenced by impingement of the vent plumes against elevated terrain surrounding the vents. However, predicted concentrations are comparatively low.

The results are discussed in terms of the effect on human health in Section 6.

[7] Institute of Air Quality Management. 2017. Land-Use Planning & Development Control: Planning for Air Quality. London.

Table 5.3: Evaluation of GLCs against assessment criteria

Contaminant	Assessment criteria (µg/m^3)	Highest GLC (µg/m^3)	Predicted location	Background concentration (µg/m^3)	Cumulative GLC (µg/m^3)	IAQM impact descriptor
CO	30,000	459 (1.5 % of criterion)	130 m NE of vent	5,000 (16.7% of criterion)	5,459 (18.2% of criterion)	Negligible
NO_X (as NO_2)	200	59.9 (30% of criterion)	130 m NE of vent	37 (19% of criterion)	96.9 (48% of criterion)	Moderate
NH_3	21,000	19.5 (0.09% of criterion)	130 m NE of vent	0 (0% of criterion)	19.5 (0.09% of criterion)	Negligible

5.5 Scaling results for other explosive types

The modelled emission rates were developed for a detonation of 1,000 kg NEQ of ANFO in the WUG explosives store. There are three explosive types expected to be stored in these chambers: ANFO, boosters and packaged explosive. The packaged explosive is an ANFO based explosive for which the ANFO detonation scenario can be considered representative. However, the boosters have a Trinitrotoluene (TNT) base (containing up to 80% TNT content). Therefore, we have also included consideration of the impact on air quality from a detonation of 1,000 kg NEQ of TNT based explosives.

Explosives manufacturer Orica has provided the detonation product breakdown for the boosters, which indicates that where 1,007 m^3 of gas is produced in a detonation of 1,000 kg NEQ, only 672 m^3 of gas would be expected for the same mass of booster (Table 5.4).

Table 5.4: Products of combustion by explosion type

Gaseous product		Yield m^3 per kg NEQ at 0°C, 1 atmosphere	
		ANFO	Booster
CH_4	methane	4.614	0.159
CO	carbon monoxide	38.0	67.6
CO_2	carbon dioxide	92.724	250.3
H_2	hydrogen	0.069	1.9
NH_3	ammonia	1.0	58.7
H_2O	water	604.2	178.7
N_2	nitrogen	263.2	114.8
NO	nitric oxide	1.5	0.381
NO_2	nitrogen dioxide	1.5	-
O_2	oxygen	-	0.008
Total volume of gas produced (m^3)		1007	672

The comparative yields for the contaminants of interest in the model are presented in Table 5.5 below. A yield of NO_2 was not provided for the TNT booster product, so consideration of the comparative yield of nitrogen gas was also included in the comparison below to approximate the yield of NO_2.

Table 5.5: Relative gas yields by explosive type for scaling the model predictions

Contaminant	Gas yield (m^3 gas per 1000 kg NEQ)		Booster to ANFO yield ratio for scaling the model predictions
	ANFO	Booster	
N_2	263.2	114.8	44%
NO_X	3.0	0.8[1]	25%
N_2 and NO_X	266.2	115.5	43%
CO	38	67.6	178%
NH_3	1	58.7	5,866%

1. Assuming equal yield of NO to NO_2 as provided for ANFO.

The comparison of the gas yields for the two explosive types shows that in the event of a detonation of booster explosives, almost twice as much CO and up to 59 times as much NH_3 may be produced as for a detonation of ANFO. However, lower volumes of both nitrogen gas and oxides of nitrogen are anticipated in a booster detonation scenario. The scaling factor of 43% has conservatively been applied to the NO_X predicted GLCs.

Using these scaling factors, the estimated GLCs for the contaminants of interest are provided in Table 5.6 below.

Table 5.6: Evaluation of scaled GLCs for a booster detonation against assessment criteria

Contaminant	Assessment criteria (µg/m³)	Pro-rated GLC (µg/m³)	Predicted location	Background concentration (µg/m³)	Cumulative GLC (µg/m³)	IAQM impact descriptor
CO	30,000	816 (2.7% of criterion)	130 m NE of vent	5,000 (16.7% of criterion)	5,816 (19.4% of criterion)	Negligible
NO_X (as NO_2)	200	25.8 (13% of criterion)	130 m NE of vent	37 (19% of criterion)	62.8 (31% of criterion)	Moderate
NH3	21,000	1,143 (5.4% of criterion)	130 m NE of vent	0 (0% of criterion)	1,143 (5.4% of criterion)	Slight

The results are discussed in terms of the effect on human health in Section 6.

5.6 Conservatism in results

The model results as provided in in the previous sub-sections are considered by T+T to be conservative due to the following:

- The contaminant concentration assumes that 100% of the full capacity of the magazine chamber combusts instantaneously.
- The emission rates used in the modelling assume that the contaminants are emitted from the surface connection at the continuous discharge rate for a full hour. In reality, the contaminant emission rates have been determined through Entech's Gas Dispersal Study in Appendix A to be exhausted from the mine in 15 minutes and 40 seconds. This will conservatively result in the modelling representing up to 4 times the mass of contaminants that will be produced by the detonation of one chamber.

- The NO_X profile was prepared assuming all emitted NO is instantaneously converted to NO_2 upon release. This reaction may be limited by the availability of ozone in the atmosphere.
- The results are presented for the meteorology conditions that produce the highest ground level concentrations. As an unplanned detonation could theoretically occur at any time under any conditions, the likelihood would be that the results will be lower.

6 Assessment of effects

The maximum 1-hour average GLC for CO in either an ANFO or booster detonation are both less than 5% of the applicable assessment criteria, which corresponds a negligible impact on air quality when considering the IAQM guidance.

The maximum 1-hour average GLC for NH_3 in an ANFO detonation is less than 0.1% of the applicable assessment criteria, while a detonation of boosters produces a maximum GLC of 5.4%. The latter corresponds to a 'slight' impact on air quality when considering the IAQM guidance. There is no anticipated background level of NH_3 in the forest park environment. Given the total concentration in the maximum case is significantly lower than the assessment criteria, the effect relative to the human health assessment criteria from the release of NH_3 from the WUG is considered negligible.

Nitrogen oxide (NO) can react with atmospheric background ozone and oxidise to form NO_2. This atmospheric conversion can be accounted for in air quality assessments. However, in this instance we have conservatively assumed all NO_X emitted is in the form of NO_2 and have added those predicted GLCs to background levels identified in Section 5.2. The peak predicted NO_X GLC is at 30% of the 1-hour average assessment criteria for NO_2 in an ANFO detonation (and 13% for a detonation of the boosters). This represents a moderate level of impact according to the IAQM criteria. However, when combined with the background concentrations, the maximum predicted cumulative 1-hour average NO_2 GLC is less than half the assessment criteria for the protection of human health. This maximum impacted location is approximately 130 m northeast of the surface vent in the Coromandel Forest Park and is approximately 830 m from the nearest point of the public walkway (which is currently closed due to repairs required at the swing bridge).

Given the above context, it is highly unlikely that a person would be located in the most impacted location during the worst-case meteorological conditions and during a failure of management controls resulting in an explosives detonation. However, even if they were present, the maximum level of NO_2 that they could be exposed to is less than half the criteria for protection of human health, and therefore the impact on human health would be less than minor.

Overall, given the level of conservatism inherent to modelling of the detonation scenario, the impact to human health from discharge of contaminants from the surface vent is very low.

7 Conclusion

This air quality assessment has been prepared on behalf of OGNZL to inform an assessment of the impact of proposed underground storage of Class 1 explosives.

The key discharges to air from the proposed vents are carbon monoxide (CO) and nitrogen dioxide (NO_2), with some ammonia (NH_3) also anticipated.

The main conclusions of the assessment are as follows:

- Predicted cumulative ambient air concentrations of CO and NH_3 in the vicinity of the proposed vents are very low when compared against human health assessment criteria. In terms of the impact on air quality in terms of the IAQM guidance, the impact from CO is 'negligible' and 'slight' for NH_3.
- Predicted cumulative concentrations of NO_2 in the vicinity of the vent raises will be, at a maximum, half the assessment criteria for the protection of human health. The locations that these peaks are predicted at are in DOC reserve forest, relatively remote from any public walking tracks. The likelihood of a detonation in the underground store occurring, simultaneous with worst-case meteorological conditions and a member of the public being present at the most impacted locations is very low.

8 Applicability

This report has been prepared for the exclusive use of our client Oceana Gold (New Zealand) Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Hauraki District Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
....	....
Rose Turnwald Environmental Engineer	Jenny Simpson Project Director

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Appendix A Gas Dispersal Study

entech.
MINING CONSULTANTS

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25th February 2022

Euan Leslie
Project Manager – WUG
Oceana Gold Waihi Operation
electronic transmittal (Euan.Leslie@oceanagold.com)

RE: WKP UG Magazine Explosion – Gas Dispersal Study.

Dear Mr. Leslie,

Entech was commissioned by Oceana Gold Waihi to provide a review on the distribution of explosion contaminants following an unintentional detonation of bulk ANFO storage. This is for the application to council for their proposed magazine site at the Wharekirauponga underground project.

Entech completed a high-level study to satisfy the requests by Tonkin and Taylor who will carry out their own environmental analysis to understand the risk to people in the nature reserve above the mine. Entech understands that ejected explosive contaminants from the mine need to be measured as a worst-case scenario, and therefore exploded material was measured as a depleted source, with resulting gases at their highest concentrations, excluding a possible fire that would normally follow such an incident.

If you have any questions relating to this report, please do not hesitate to contact me directly.

Signed for and on behalf of Entech Pty Ltd,

Anthony Evernden

Ventilation Consultant

Distribution: Original held by Entech Pty Ltd

1 SUMMARY

Analysis of contaminant dispersal following the simulated unintentional detonation of explosive storage, underground at Wharekirauponga (WKP) mine in NZ, was completed using Ventsim™ software. Worst case was measured using simulation presets for ANFO explosives, with the maximum bulk storage exploding as a single event and no resulting fire.

The maximum bulk storage of ANFO was 1 t, and the simulation was set to the fastest dispersal factor so that maximum concentration of explosion gases could be simulated. Only gas concentrations exiting to surface were reported. An underground assessment of gas dispersal around workplaces is out of scope for this report. Tonkin and Taylor (T&T) will carry out the environmental impact for the surrounding nature reserve. They requested the following information to complete their work:

- Only those gases produced from ANFO that are toxic to life were analysed.
  - Carbon monoxide (CO).
  - Nitrous Oxide (NO).
  - Nitrogen Dioxide (NO_2).
  - Ammonia (NH_3).
- Total volume of gas produced by the explosion.
  - Calculated at 1,007 m³ (see section 4.2).
- Discharge rate in grams per second (g/s) for contaminants exiting to surface.
  - Converted from gas concentrations (see Table 4-3).
- Discharge duration to be a minimum of one hour.
  - Full discharge duration of contaminants is provided in section 4.4.
- Air volume, velocity, and temperature of discharge at surface (see section 4).
  - There was no change in air speed or temperature at surface connections.
  - Shortest air path from the explosion is 650 m if exhausting via Rise 2.
- All the gas will be ejected to the nature reserve above under mechanical ventilation (primary exhaust fan operating) via Rise 2.
- Surface connection dimensions, along with their coordinates are mentioned in Section 4.

Seasonal variance was assessed for natural ventilation flow in the event of power failure. Overall mine airflow drops to 4% of the total flow under mechanical ventilation and gas can take more than three days to clear the mine. Subsequently, gas concentrations peak 80% less than when fans are running at full speed.

This is a high-level assessment of gas dispersal for this type of incident. It is recommended that CFD modelling is conducted for a more accurate understanding of how gases will impact on the local environment once they reach ground level.

2 SIMULATION PARAMETERS & ASSUMPTIONS

2.1 DESIGN PARAMETERS & ASSUMPTIONS

For contaminant dispersal, following unintentional detonation of ANFO in underground bulk storage facility, the following parameters and assumptions were used.

Table 2-1 – Parameters and definitions used in this study.

<table>
<tr><th>Parameter Description</th><th colspan="3">Design Parameter</th><th>Remarks</th></tr>
<tr><td rowspan="5">Hazard is defined by workplace exposure standards for airborne contaminants.

Toxic gases associated with ANFO explosives; carbon monoxide (CO), nitrous oxide (NO), nitrogen dioxide (NO_2) & ammonia (NH_3).</td><td>Gas</td><td>TWA (ppm)</td><td>STEL (ppm)</td><td rowspan="5">Exposure standards set by Work Safe NZ.

*The short-term exposure limit (STEL) for CO was derived from the 60 min short term excursion limit per 8-hour shift (different to that which defines STEL).

**Where a limit was not made available, Safe Work Australia's was used.</td></tr>
<tr><td>CO</td><td>25</td><td>50*</td></tr>
<tr><td>NO</td><td>25</td><td>45**</td></tr>
<tr><td>NO_2</td><td>1</td><td>5**</td></tr>
<tr><td>NH_3</td><td>25</td><td>35</td></tr>
<tr><td>Maximum storage capacity for ANFO underground.</td><td colspan="3">1,000 kg</td><td>Maximum individual storage limit. Resulting explosions from additional storage capacities were not considered in this study.</td></tr>
<tr><td>Surface Connection.</td><td colspan="3">Airway opening to underground mine workings.</td><td>Boundary between underground and surface atmosphere.</td></tr>
<tr><td>Mechanical ventilation.</td><td colspan="3">Airflow according to fan pressures.</td><td>Underground airflow defined by the mechanical action of an industrial fan.</td></tr>
<tr><td>Natural ventilation.</td><td colspan="3">Airflow in the absence of primary fans.</td><td>Underground airflow defined by ambient conditions, with air entering and exiting the mine according to natural pressure changes.</td></tr>
</table>

Analysis and outputs for this study were generated using Ventsim™ simulation software. A calibrated working model of the mine ventilation network was provided by WKP along with the following design assumptions.

1) Mechanical ventilation by:
    a) Proposed underground primary fan is linked to the Rise 2 exhaust.
        i) The simulation's fixed flow is set to 390 m^3/s at full speed.
2) Natural ventilation simulations assume exhaust fan will be closed to surface.
    a) Damper doors on the primary fan will prevent air reversal when power is turned off.
    b) Damper doors will not open under natural ventilation pressure.
3) Ambient conditions set to the 95th percentile for mean monthly wet bulb temperatures and their associated coincidental dry bulb temperatures, as defined by ASHRAE, for the Tauranga weather station in NZ.
    a) Summer conditions:
        i) WB @ 21 ^oC.
        ii) DB @ 23 ^oC.
        iii) Surface barometric pressure @ 98.5 kPa.
    b) Winter conditions:
        i) WB @ 13 ^oC.
        ii) DB @ 15 ^oC.
        iii) Surface barometric pressure @ 98.5 kPa.
4) Ventsim™ default presets for ANFO were used to define gas concentrations produced by the explosion of ANFO in bulk storage. It was assumed that these presets would present a conservative outcome regarding risk by toxic airborne contaminants. Those gases provided by Orica Australia, represented in Table 4-2, although the majority are non-toxic to life, were used for calculating gas volume only and were excluded from the rest of the study.
    a) Individual gas yields, used to determine gas concentrations, are defined under the category of ANFO 92/8 in Ventsim™ and are as follows.
        i) CO @ 38 L/kg.
        ii) NO @ 1.5 L/kg.
        iii) NO_2 @ 1.5 L/kg.
        iv) NH_3 @ 1 L/kg.
    b) Dispersion factor was set to 'very fast' to present gas concentrations at their instantaneous highest concentrations.

The digital Ventsim™ files 'Entech_WKP CL_used simulation GT request_03 - Summer' and 'Entech_WKP CL_used simulation GT request_03 - Winter' accompany this report and should be referred to for additional clarification.

NOTE: this study is measuring a worst-case scenario, therefore the study assumes an ignition source to create the explosion and that 100% of the product will combust instantaneously, thus producing the highest concentration of gas.

3 PRIMARY VENTILATION LAYOUT

3.1 VENTILATION CONNECTIONS TO SURFACE

The locational map Figure 3-1, for WKP's surface connections to underground workings was provided by WKP. These surface connections are the focus for assessing the hazards to the local surrounds.

All surface connections are vertical shafts except for the two access portals Plant and Willows.

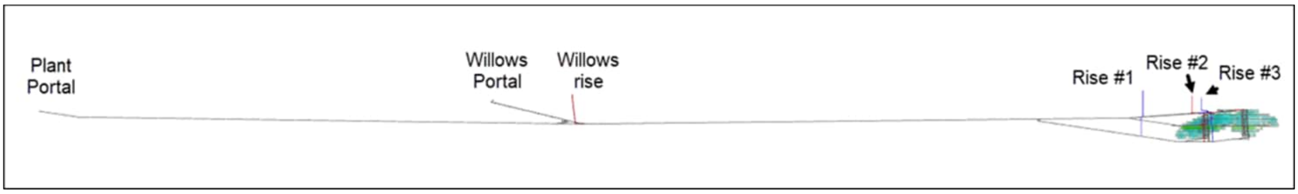


Figure 3-1 – WKP surface connections.

Plant and Willows portals are the vehicle access points to the mine, with Plant being ~10 km from the production area. Rise 1 is the proposed fresh air intake and Rise 2 the exhaust shaft. For the sake of this study, Rise 3 and Willows Rise will be considered closed to surface.

3.2 VENTILATION PATH FOR MAGAZINE EXPLOSION GASES

Under mechanical ventilation Rise 2 return air rise (RAR) is the sole exit point for blast contaminants. Due to the location of the bulk explosive storage facility, being 380 m below surface, no flow reversal because of the blast will occur at any of the other surface connections. If fans switch off due to power failure, then the natural ventilation flow within the mine may see other connections dispersing contaminants such as Rise 1 fresh air rise (FAR) and the two haulage portals Plant and Willows.

The modelling suggests that WKP will be highly variable during natural ventilation flow. This means that changes in atmospheric conditions could switch the blast fume path between the open connections, presenting two scenarios for the exhaust path. Scenario 1 sees the fresh air entering the Plant and Willows portals with contaminated air exiting via Rise 1. Scenario 2 sees this in reverse, with Rise 1 down casting fresh air and contaminated air exiting via the Plant and Willows portals. This variability suggests that with only minor changes in barometric pressures, blast fumes could be trapped underground for protracted periods until mechanical ventilation is restored.

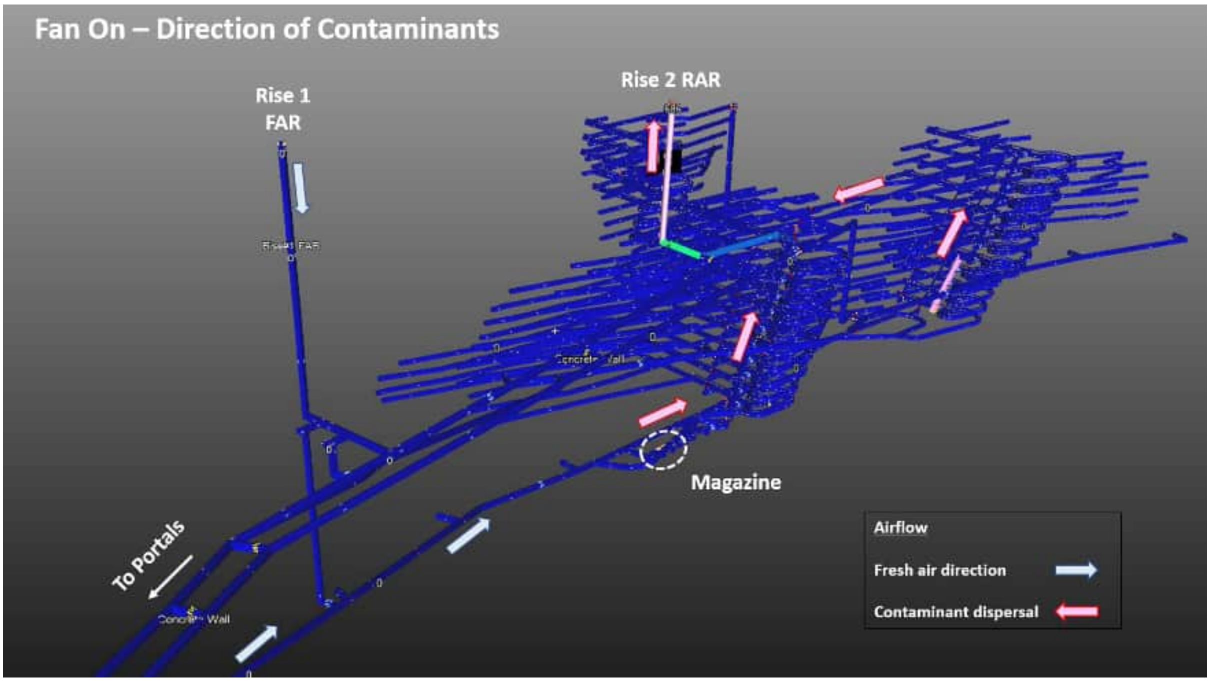


Figure 3-2 – Explosion gas dispersal path during mechanical ventilation.

Rise 2 will have the main fan attached to it, making this the direct exhaust connection to surface. Figure 3-2 indicates blast fume dispersal will occur via internal exhaust shafts linked to Rise 2.

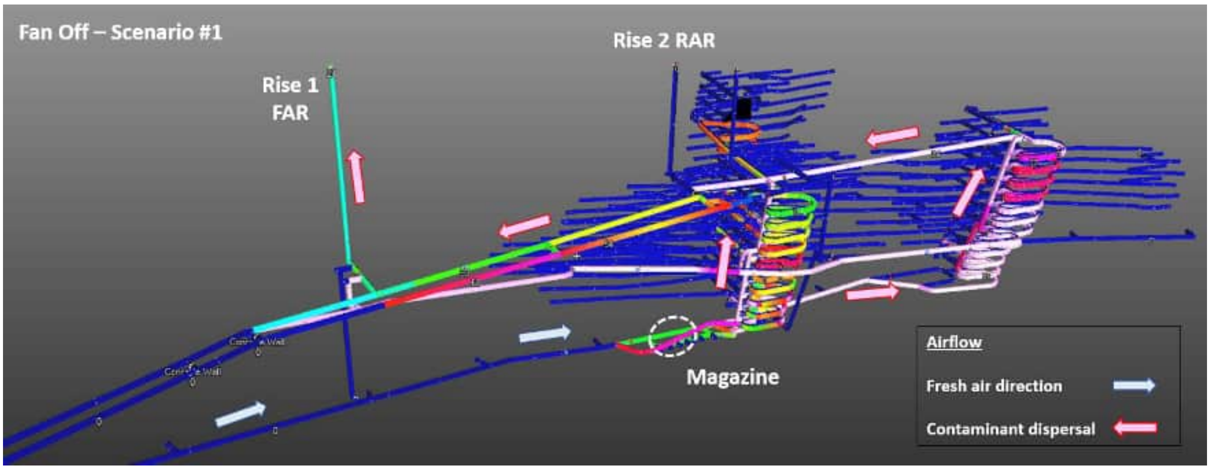


Figure 3-3 – Explosion gas dispersal path during natural ventilation, scenario 1.

Figure 3-3 shows the contaminant path for scenario 1 when the main fan is switched off. Blast fume dispersal will recirculte around travel routes and internal shafts before finding its way out of the mine via Rise 1.

Figure 3-4 shows the alternate path when fans are switched off. Fesh air will enter the mine via Rise 1, and contaminated air will recirculate around main travel routes, before making its way out the two haulage portals.

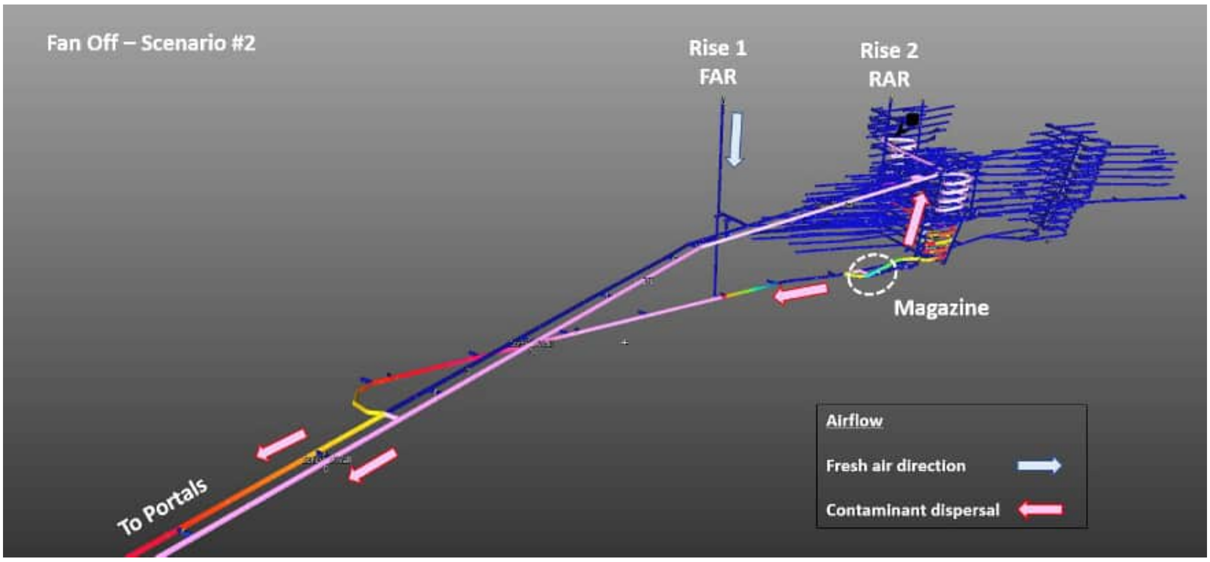


Figure 3-4 – Explosion gas dispersal path during natural ventilation, scenario 2.

Seasonal variation indicates that the winter fume path will only be reflected in sccenario 1. It appears that the minimal airflow in winter maintains Rise 1 as the primary exhaust, assuming that the diffeneces in surface and underground air densities creates a repeatable bouyancy[1] effect. Air will then seek the nearest opening out of the mine, drawing cooler air in from the portals.

It should be noted that challenges exist in predicting natural ventilation due to the effects of heat imposed on airflow from mining activities. During a mine emergency, such as power failure to the primary fan, the loss of activity will create a cooling effect and may see flow stagnation, and eventual reversal, over the full duration of the event. This means that predicting events according to scenario 1 and 2 as a constant, for the entire event, may be impossible and should be cross referenced with natural ventilation surveys.

[1] *Buoyancy in underground mines results from the density differences between underground and surface air, causing warm air to rise above the chilly intake air. This creates an upward airstream through Rise 1.*

4 ANALYSIS

4.1 SURFACE CONNECTION PARAMETERS

The surface connection parameters provided in Table 3-5 was requested by T&T to assist in their follow-up analysis. Those connections exhausting contaminants are highlighted in red.

Summer conditions reflects the two scenarios for fume dispersal when winter only has the one outcome.

The volumetric airflow under natural ventilation is only 4% of that under mechanical ventilation and is half that again in the colder months.

Table 4-1 – Surface connection parameters.

Parameters		Plant Portal	Willows Portal	Willows Rise	Rise 1 FAR	Rise 2 RAR	Rise 3 FAR
Coordinates (NZMG)	X	2,764,014	2,763,573	2,762,466	2,760,442	2,760,466	2,760,478
	Y	6,419,939	6,423,686	6,424,329	6,429,033	6,429,434	6,429,513
	Z	101	190	240	274	230	216
Shape & Orientation		Arched Horizontal	Arched Horizontal	Round Vertical	Round Vertical	Round Vertical	Round Vertical
Dimensions	W (m)	5.0	5.0	Ø 5.0	Ø 5.0	Ø 5.5	Ø 5.0
	H (m)	5.5	5.5				
	A (m^2)	25.8	25.8	19.6	19.6	23.8	19.6
Shortest Path from UG Magazine (m)		10,329	6,995	5,923	899	651	756
Primary Fan Fan On (Rise 2 Upcasting)							
Surface Connection Velocity		2.1 m/s	2.9 m/s	Blocked - Shaft not Used	13.4 m/s	16.4 m/s	Blocked - Shaft not Used
Volumetric Airflow of Entire Mine		391 m^3/s; 437 kg/s	391 m^3/s; 437 kg/s		391 m^3/s; 437 kg/s	391 m^3/s; 437 kg/s	
Surface Connection Volumetric Airflow		54 m^3/s; 61 kg/s	75 m^3/s; 84 kg/s		262 m^3/s; 293 kg/s	387 m^3/s; 437 kg/s	
Apportionment of Volumetric Flow		14%	19%		67%	100%	
1. Summer - Primary Fan Off (Rise 1 Upcasting)							
Surface Connection Velocity		0.2 m/s	0.5 m/s	Blocked - Shaft not Used	0.9 m/s	Blocked by Fan Dampers	Blocked - Shaft not Used
Volumetric Airflow of Entire Mine		17.4 m^3/s; 19.4 kg/s	17.4 m^3/s; 19.4 kg/s		17.4 m^3/s; 19.4 kg/s		
Surface Connection Volumetric Airflow		4.8 m^3/s; 5.5 kg/s	12.4 m^3/s; 13.9 kg/s		17.4 m^3/s; 19.4 kg/s		
Apportionment of Volumetric Flow		28%	72%		100%		
2. Summer - Primary Fan Off (Rise 1 Downcasting)							
Surface Connection Velocity		0.4 m/s	0.4 m/s	Blocked - Shaft not Used	1.0 m/s	Blocked by Fan Dampers	Blocked - Shaft not Used
Volumetric Airflow of Entire Mine		20.2 m^3/s; 22.6 kg/s	20.2 m^3/s; 22.6 kg/s		20.2 m^3/s; 22.6 kg/s		
Surface Connection Volumetric Airflow		9.5 m^3/s; 10.7 kg/s	10.6 m^3/s; 11.9 kg/s		20.2 m^3/s; 22.6 kg/s		
Apportionment of Volumetric Flow		47%	53%		100%		
Winter - Primary Fan Off (Rise 1 Upcasting)							
Surface Connection Velocity		0.2 m/s	0.2 m/s	Blocked - Shaft not Used	0.5 m/s	Blocked by Fan Dampers	Blocked - Shaft not Used
Volumetric Airflow of Entire Mine		10.6 m^3/s; 12.4 kg/s	10.6 m^3/s; 12.4 kg/s		10.6 m^3/s; 12.4 kg/s		
Surface Connection Volumetric Airflow		5.2 m^3/s; 6.1 kg/s	5.4 m^3/s; 6.3 kg/s		10.6 m^3/s; 12.4 kg/s		
Apportionment of Volumetric Flow		49%	51%		100%		

Key
Exhaust
Intake

4.2 GAS VOLUME

Gas volume produced by the explosion is determined using gas yields (L/kg) provided by Orica Australia (Table 4-2) combined with the toxic gas default yields provided by the Ventsim™ simulation.

Table 4-2 – Gas mix for bulk store ANFO explosion provided by Orica Australia, along with the gas volume equation.

AMEX			
Gas	g / 100g %	litres / kg	litres / 4tne
Methane	0.3303	4.614	18456
Carbon dioxide	18.2066	92.724	370896
Hydrogen	0.0006	0.069	276
Ammonia	0.0009	0.012	48
Water	48.5665	604.243	2416972
Nitrogen	32.8985	263.224	1052896

Gas production per kg of explosive:

$$V_P = \frac{G_C}{1000} * M$$

Where:

V_p = the volume of gas produced (m^3)

G_C = Gas concentration (l/kg)

M = mass of explosive (kg)

NOTE: Table 4-2 reflects the substances produced from the explosion of ANFO in ideal conditions[2], however, Entech considers that it is counter intuitive to exclude the toxic gases usually experienced under normal mining applications.

Combining all elements, the gas volume is estimated to be 1,007 m^3.

The Ventsim™ simulation's default yield for NH_3 was used instead of the Orica yield to be conservative.

4.3 PEAK CONTAMINANT CONCENTRATIONS

Table 4-3 indicates the peak contaminant concentrations at each surface connection during primary fan operation and when mains power is off. Seasonal variation between summer and winter was compared during power failure. Note that scenario 2 was only present in summer.

T&T requested that gas concentrations be referenced in grams per second (g/s), along with exiting velocities, and temperatures.

[2] *Ideal conditions reflect a well-balanced mixture of ammonium nitrate and diesel, with no water contamination. The more conditions are less than ideal the greater the prevalence of toxic gases.*

Table 4-3 – Peak contaminant volumes per surface connection w. fans on and off.

Units	Peak Gas Concentrations @ Exhaust Points				
	Fan ON	Summer 1. Fan OFF	Summer 2. Fan OFF		Winter Fan OFF
	Rise 2	Rise 1	Plant Portal	Willows Port.	Rise 1
Temp (^oC)	21.4	21.8	22.9	22.3	14.7
BP (hPa)	971	966	985	975	965
V (m/s)	16.4	0.9	0.4	0.4	0.5
CO (ppm)	2929.3301	582.5932	294.7679	523.5465	160.0842
MM (g/mol)	28	28	28	28	28
mg/m³	3,254.7148	643.0996	330.5481	582.3172	180.8836
g/m³	3.2547	0.6431	0.3305	0.5823	0.1809
Q (m³/s)	390	17.4	9.5	10.6	10.6
g/s	1,269.3	11.2	3.1	6.2	1.9
NO (ppm)	115.9846	23.0110	11.6391	20.6776	6.3202
MM (g/mol)	30	30	30	30	30
mg/m³	138.0729	27.2152	13.9842	24.6415	7.6514
g/m³	0.1381	0.0272	0.0140	0.0246	0.0077
Q (m³/s)	390	17.4	9.5	10.6	10.6
g/s	53.8	0.5	0.1	0.3	0.1
NO2 (ppm)	115.6315	22.9971	11.6356	20.6663	6.3191
MM (g/mol)	46	46	46	46	46
mg/m³	211.0670	41.7048	21.4359	37.7631	11.7302
g/m³	0.2111	0.0417	0.0214	0.0378	0.0117
Q (m³/s)	390	17.4	9.5	10.6	10.6
g/s	82.3	0.7	0.2	0.4	0.1
NH3 (ppm)	77.3231	15.3407	7.7594	13.7850	4.2134
MM (g/mol)	17	17	17	17	17
mg/m³	52.1609	10.2813	5.2829	9.3090	2.8905
g/m³	0.0522	0.0103	0.0053	0.0093	0.0029
Q (m³/s)	390	17.4	9.5	10.6	10.6
g/s	20.3	0.2	0.05	0.1	0.03

Velocity and temperature at surface connections did not change during the modelling, indicating that the explosion's influence on airflow and heat was localised at the source.

4.4 TIME DURATION OF CONTAMINANT DISPERSAL

Contaminant dispersal was Simulated at the fasted rate of release, which would see the highest contaminant concentration as the gas front exits the surface connection. Gas dispersal will be affected by fan operation, the alternate routes that gas takes as it makes its way through the underground workings, and the ambient conditions affecting airflow (when fans are off). This can result in multiple minor peak concentrations and take several hours, or even days to clear, if the main fan is switched off for instance.

Table 4-4 looks at the period that each gas is hazardous as it exits the mine and compares this with the combined contaminant duration. The full contaminant duration is determined when the combined contaminants are above 0.5 ppm. The degree of hazard for each gas can be measured with the time that the contaminant stays above its TWA and STEL.

Table 4-4 - Contaminant duration according to exposure standards.

Duration of Dispersal							
Contaminant	Vent Status	Fan On	1. Fan Off	2. Fan Off		Fan Off Winter
	Exhaust	Rise 2	Rise 1	Plant Portal	Willows Portal	Rise 1
	Time Format	M:S	D:H:M:S	D:H:M:S	D:H:M:S	D:H:M:S
Combined Gas Duration > 0.5ppm*	Start	01:29	00:03:22:50	00:09:33:40	00:06:39:50	00:15:07:30
	End	17:11	00:16:40:50	01:05:41:20	01:02:51:40	03:12:18:40
	Period	15:40	00:13:18:00	00:20:07:40	00:20:11:50	02:21:11:10
CO	Period > TWA	01:27	00:05:37:50	00:04:51:10	00:04:36:10	00:06:26:40
	Period > STEL	01:23	00:02:29:10	00:01:03:30	00:01:20:20	00:01:18:50
NO	Period > TWA	00:43	00:00:00:00	00:00:00:00	00:15:52:20	00:00:00:00
	Period > STEL	00:25	00:00:00:00	00:00:00:00	00:00:00:00	00:00:00:00
NO2	Period > TWA	01:57	00:13:02:00	00:16:07:00	00:15:52:20	01:00:24:40
	Period > STEL	01:12	00:00:51:00	00:00:00:00	00:00:31:00	00:00:08:40
NH3	Period > TWA	00:00	00:01:51:00	00:00:00:00	00:00:00:00	00:00:00:00
	Period > STEL	00:00	00:00:00:00	00:00:00:00	00:00:00:00	00:00:00:00

*NO2 duration for > 0.5 ppm is used when the combined gas duration is protracted, i.e., when fans are off, as all gases are already at safe levels.

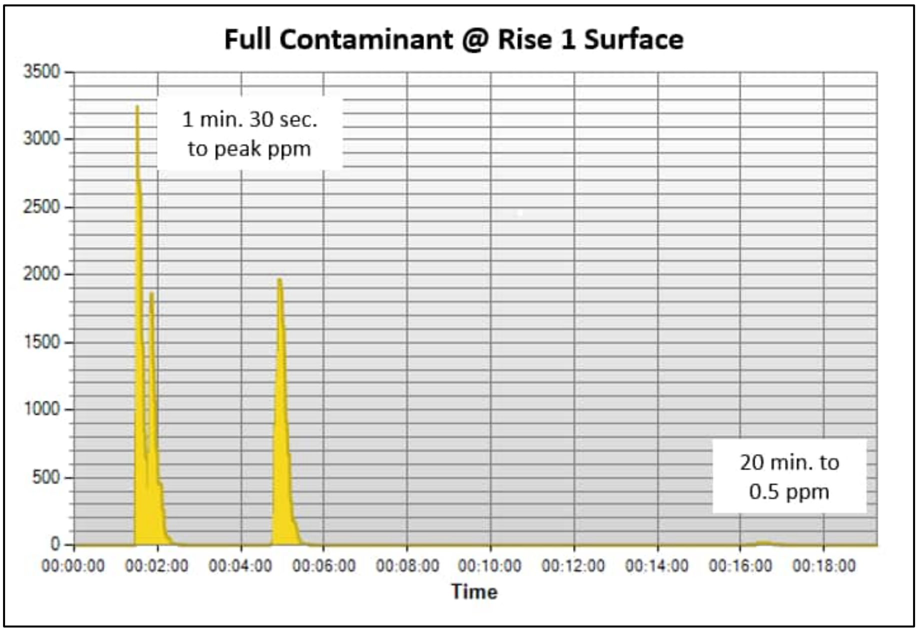


Figure 4-1 – Gas concentration in ppm over time, exhausting via Rise 1.

With the primary fan drawing 390 m³/s, the fuming event is over within 16 minutes. The second peak in concentration relates to the delay in fumes taking the northern exhaust route.

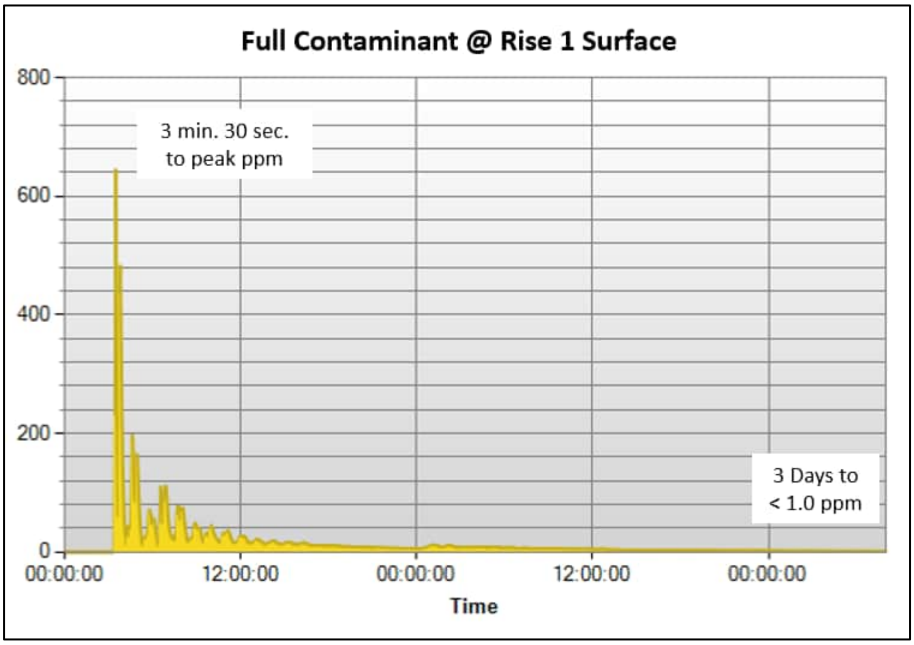


Figure 4-2 – Gas concentration in ppm over time, exhausting Rise 1.

Under summer conditions, natural pressure changes in the mine sees NO_2 exhausting at safe levels within 13 hours of the explosion. Residual gases clear within two and a half days.

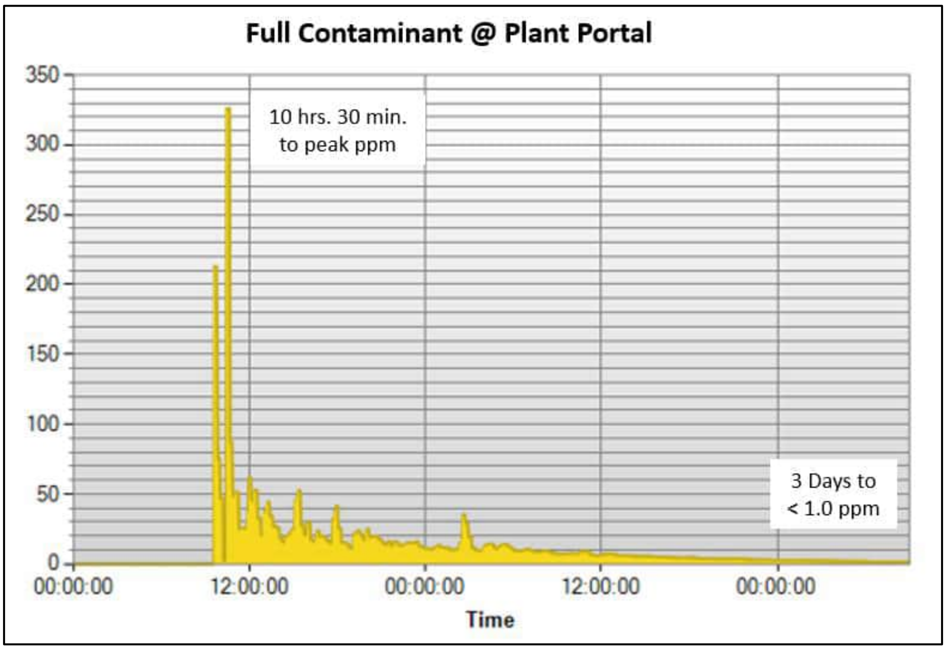


Figure 4-3 – Gas concentration in ppm over time, exhausting Plant Portal.

It takes approximately 16 hours to exhaust NO_2 at safe levels from the Plant Portal, with residual gases clearing after two days.

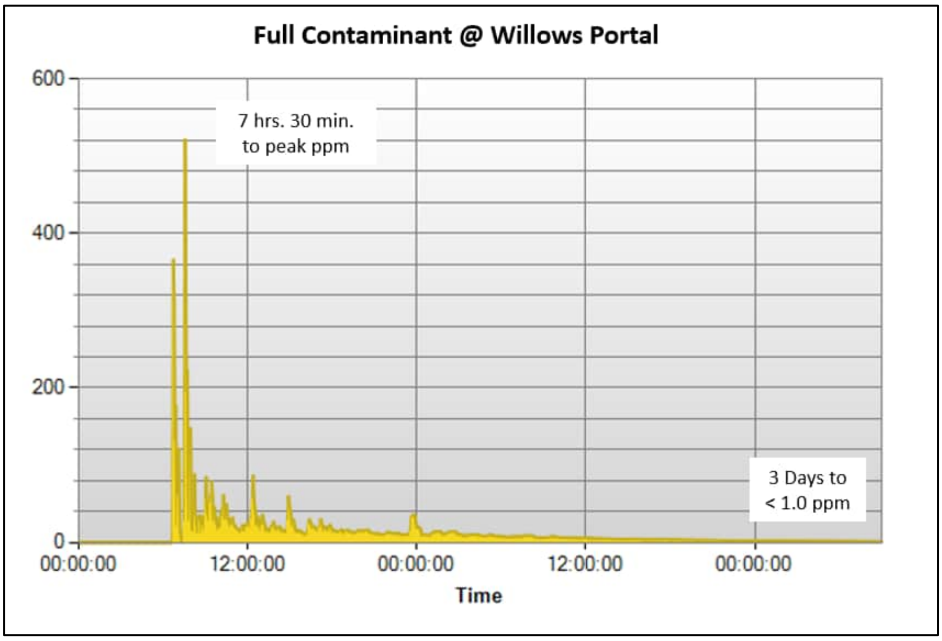


Figure 4-4 – Gas concentration in ppm over time, exhausting Willows Portal.

It takes a similar amount of time to exhaust NO_2 at safe levels from the Willows Portal, with residual gases clearing after two days.

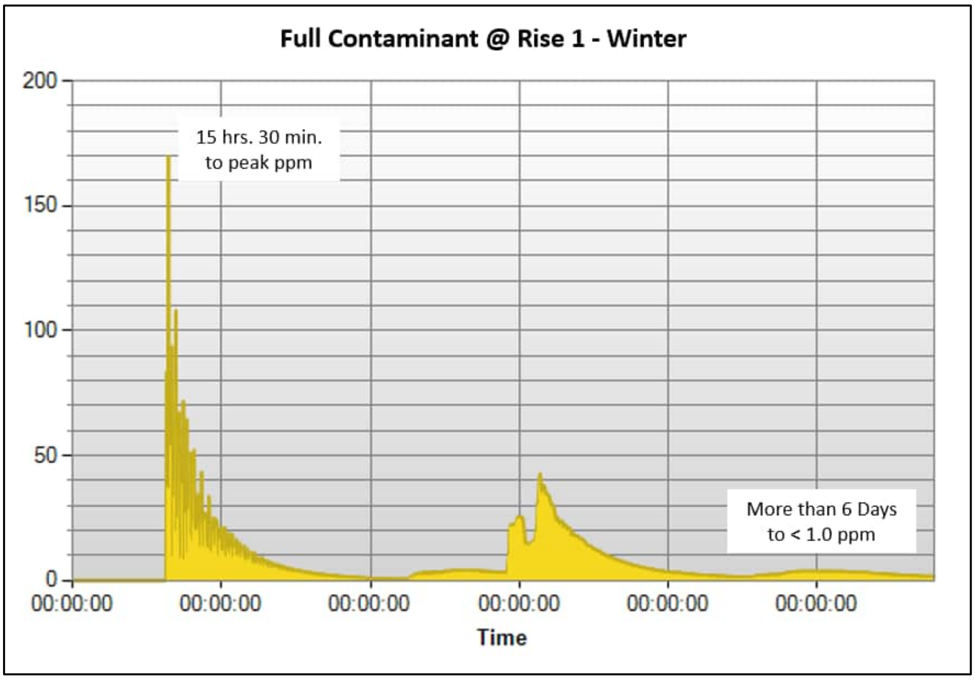


Figure 4-5 – Gas concentration in ppm over time, exhausting Rise 1 in Winter.

With considerably reduced flows, the time it takes to exhaust NO_2 at safe levels increases to one day under winter conditions, with over three days for residual gas to clear.

5 RECOMMENDATIONS

- Always back up natural ventilation modelling with underground surveys to validate assumptions. Electrical maintenance periods are a good opportunity. Repeatability in the summer modelling of natural ventilation was difficult, which reflects the highly variable nature imposed on WKP by the low volumetric flows affected by heat loads and atmospheric pressures.
- Consider the potential impacts that an explosion of this magnitude will have on mine infrastructure, which may include resulting fire or further explosions from other flammables.

Appendix B Emission rate development

B1 Emission scenarios

Entech have evaluated the concentrations at the surface connections for the following ventilation scenarios:

1 Forced ventilation: in the event that the fans are not damaged in the explosion, the mine ventilation will exhaust all contaminants at Site 5 – Rise #2 vent.

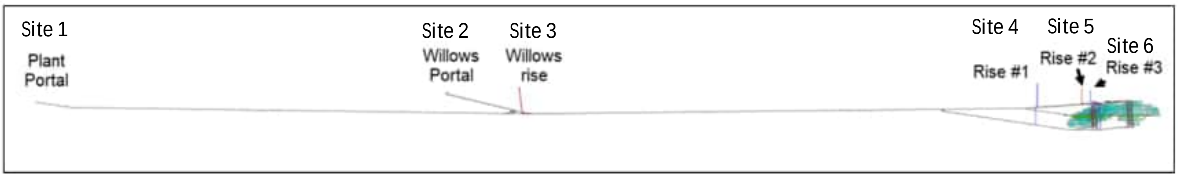
2 Natural ventilation: in the event that the fan systems are damaged, the contaminants are expected to slowly disperse through the mine and may be emitted from Site 4 – Rise #1 or the two portal connections (Site 1 and Site 2) on OGNZL owned land. Volumetric flow in the natural ventilation scenario is 4.5% of that under mechanical ventilation and the contaminants take between 13 hours to three days to clear the underground mine.

The parameters for each scenario are shown in Appendix B Table 1 below. This demonstrates that the scenario that will provide the most conservative assessment is the release of contaminants at high concentration over a short duration from Site 5 – Rise #2 under mechanical ventilation.

Appendix B Table 1: Emission scenarios and parameters (Entech, 2022)

	Mechanical ventilation	Natural ventilation - Summer			Natural ventilation - Winter
	Fan on	1. Fan off	2. Fan off		Fan off
Parameter	Site 5 – Rise #2	Site 4 – Rise #1	Site 1 – Plant Portal	Site 2 – Willows Portal	Site 4 – Rise #1
Temp (ºC)	21.4	21.8	22.9	22.3	14.7
BP (hPa)	971	966	985	975	965
V (m/s)	16.4	0.9	0.4	0.4	0.5
Q (m^3/s)	387	17.4	9.5	10.6	10.6
Duration of release	15 minutes 40 seconds	13 hours 18 minutes	20 hours 7 minutes	20 hours 11 minutes	2 days 21 hours
CO (g/s)	1,269.3	11.2	3.1	6.2	1.9
NO (g/s)	53.8	0.5	0.1	0.3	0.1
NO2 (g/s)	82.3	0.7	0.2	0.4	0.1
NOX (g/s)	164.6	1.4	0.4	0.8	0.2
NH3 (g/s)	20.3	0.2	0.05	0.1	0.03

The relative locations of the different surface connections are indicated on Appendix B Figure 1 below.



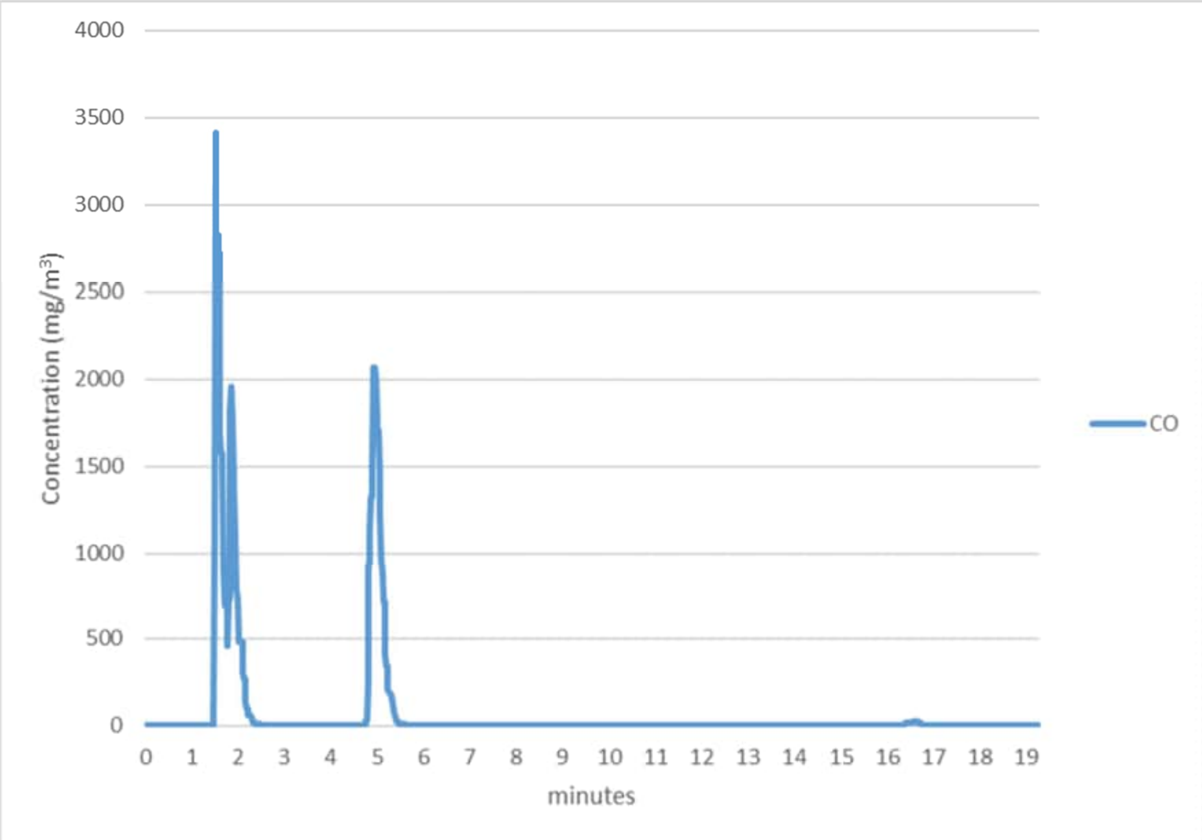
Appendix B Figure 1: Surface connections *Source: OGNZL*

B2 Emission profile

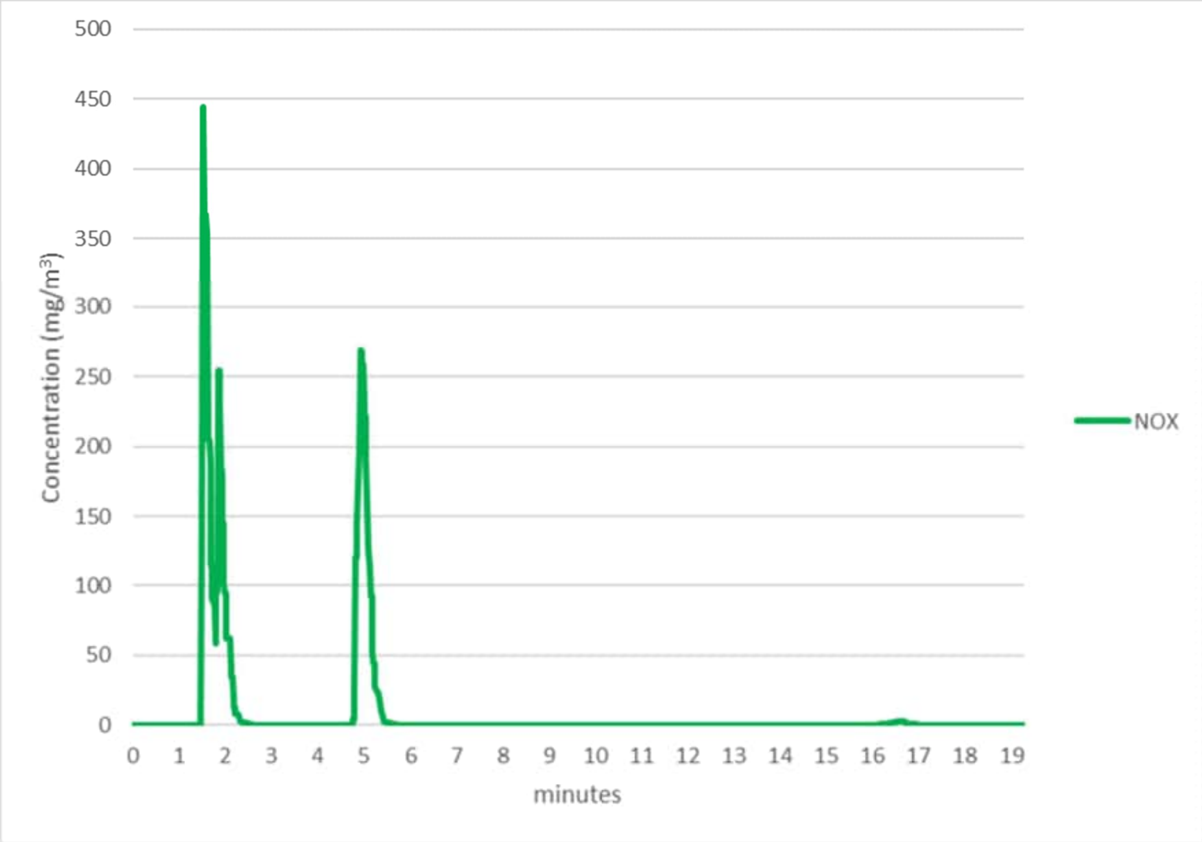
The emission profile for the mechanically ventilated scenario shows that all the contaminants produced by the detonation are exhausted from the Site 5 in under 20 minutes.

The emission profile for each contaminant from Site 5 are shown in Appendix B Figure 2 to Appendix B Figure 4. The NO_X profile was prepared assuming all emitted NO is instantaneously converted to NO_2 upon release.

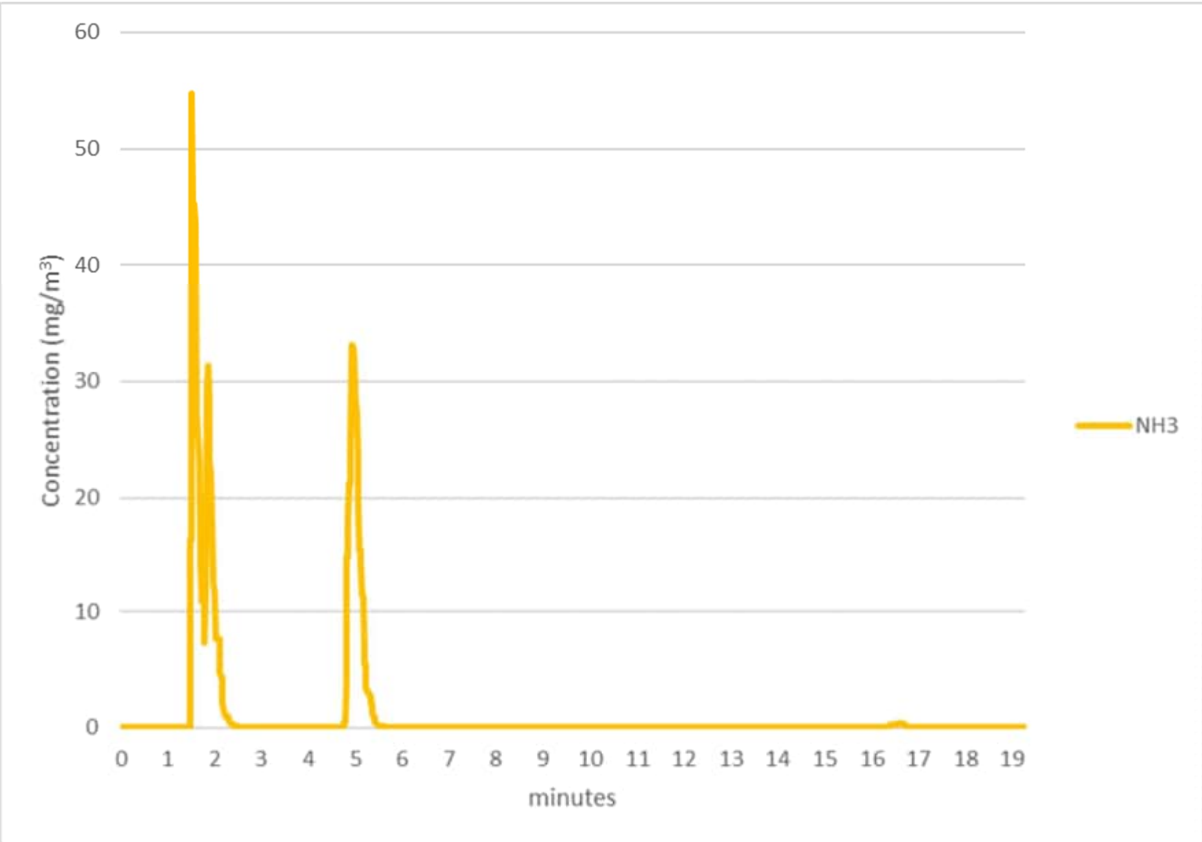
The instantaneous concentration of each contaminant in parts per million as provided in the Gas Dispersal Study in Appendix A has been converted to milligrams per cubic meter using the molar mass of the contaminant and the volume of 1 mol at atmospheric pressure and 20°C.



Appendix B Figure 2: Concentration of emitted CO from Site 5



Appendix B Figure 3: Concentration of emitted NO_X from Site 5



Appendix B Figure 4: Concentration of emitted NH_3 from Site 5

B3 Representative continuous emission rate

Dispersion modelling requires the input of a continuous emission rate of each contaminant. The concentration of each contaminant (and consequently the emission rate) varies substantially over 15 minutes and 40 seconds (or 940 seconds) before the detonation products are considered fully exhausted. In order to find a representative continuous emission rate, the total mass released of each contaminant was calculated and averaged over the release time for a conservative emission rate as follows:

The emission concentration profile in milligrams per cubic metre (mg/m^3) was converted to a mass at each time interval (one second) using the volumetric flow rate for Site 5 – Rise #2 (387 m^3/s).

$$Mass = \frac{\text{C x V}}{1000}$$

Where:

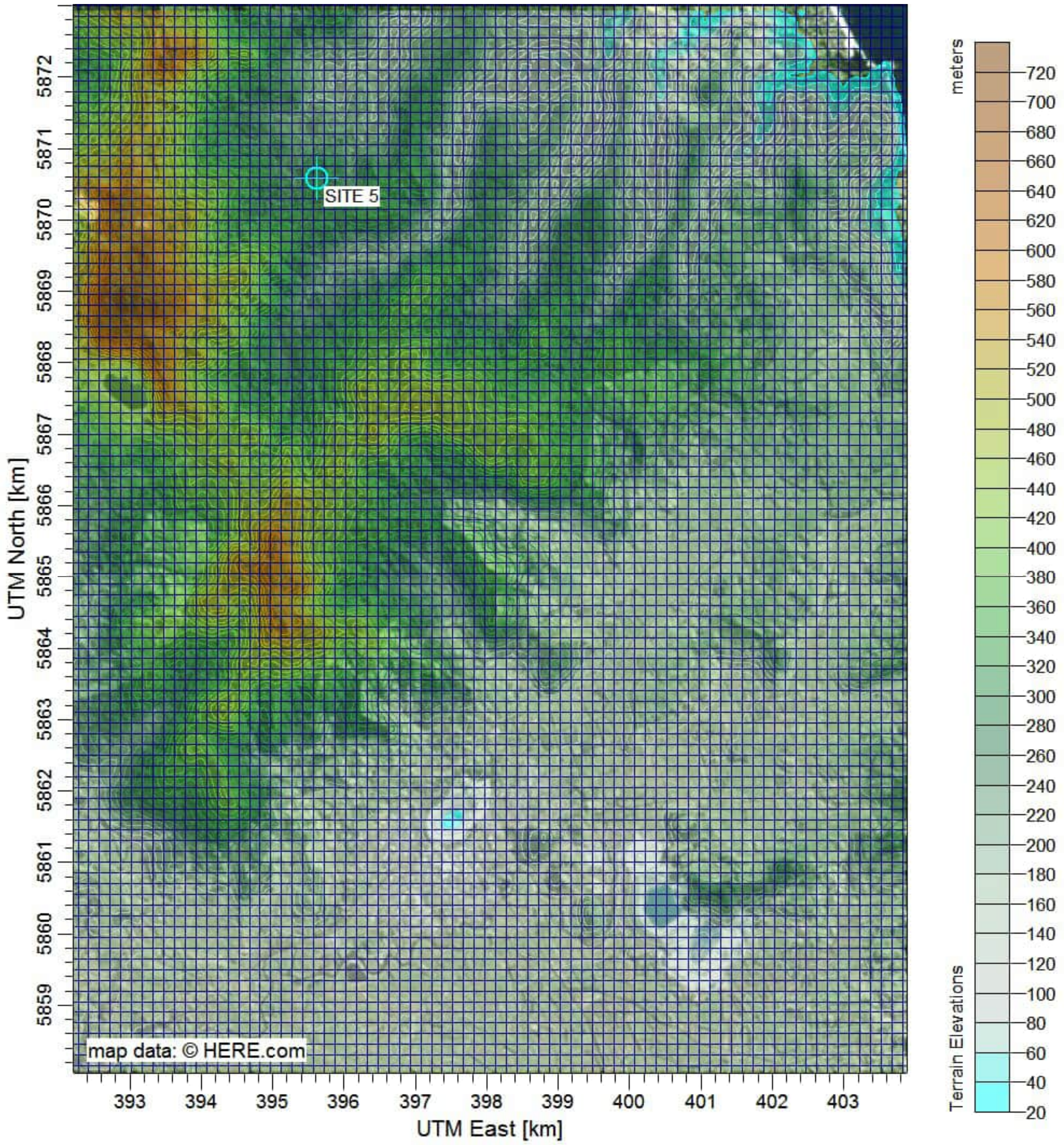
- C is the instantaneous predicted concentration at the mine conditions in mg/m^3, and
- V is the volumetric flow rate from the surface connection in m^3/s and
- The mass is calculated in grams.

Each one-second mass value was summed together to predict the total mass emission over the duration of the release, shown in Appendix B Table 2 below. The total mass was then divided over the total number of seconds to provide a representative continuous emission rate in grams per second for the period. This continuous emission rate was used in the modelling, providing a conservative result in which 3 - 4 times the amount of contaminant is emitted over an hour.

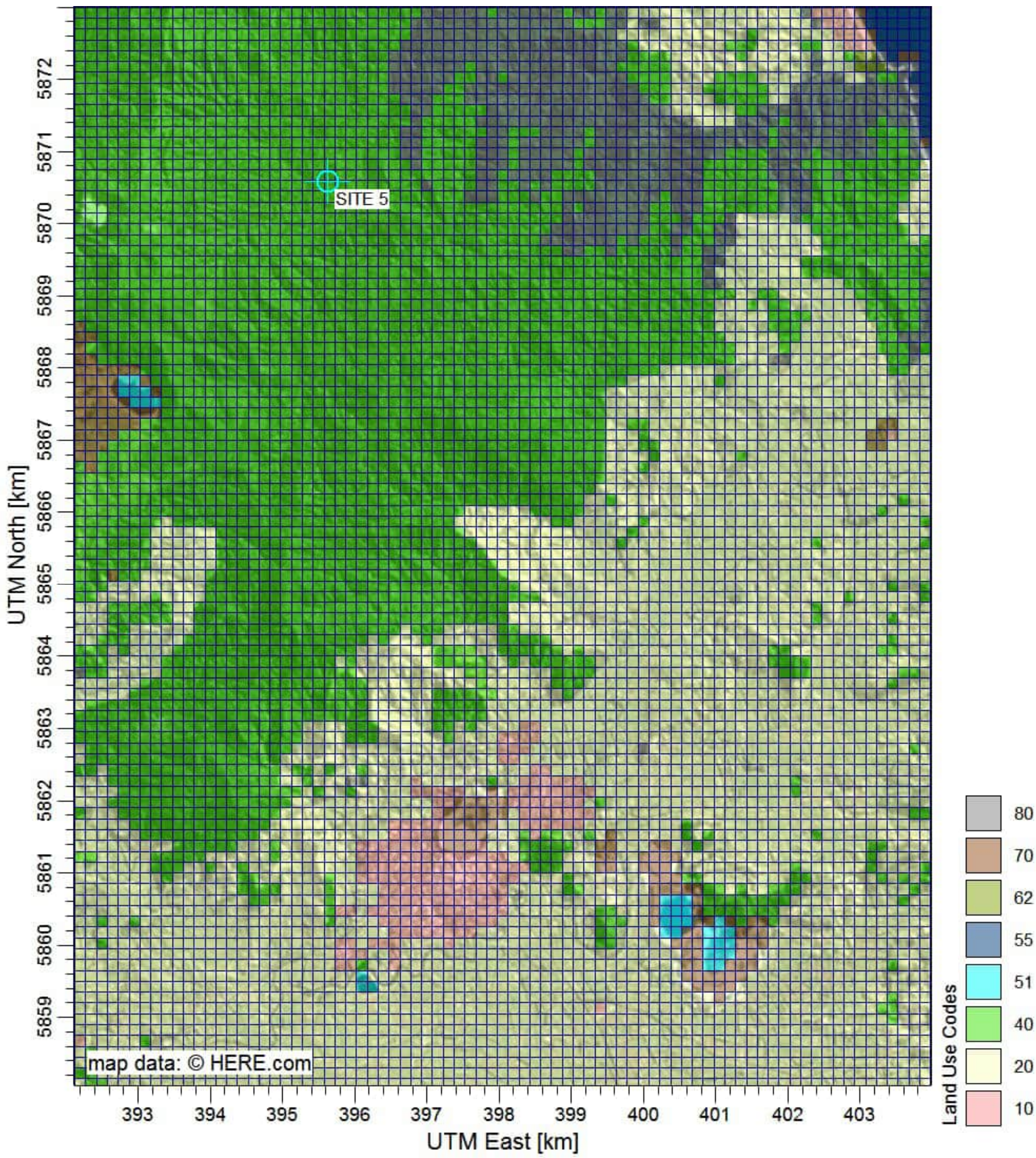
Appendix B Table 2: Calculation of continuous emission rate

	Contaminant		
	CO	NO_X	NH_3
Mass emitted over 940 seconds (g)	33,077	4,293	1,401
Corresponding continuous emission rate (g/s)	35.2	4.6	1.5

Appendix C CALMET domain figures

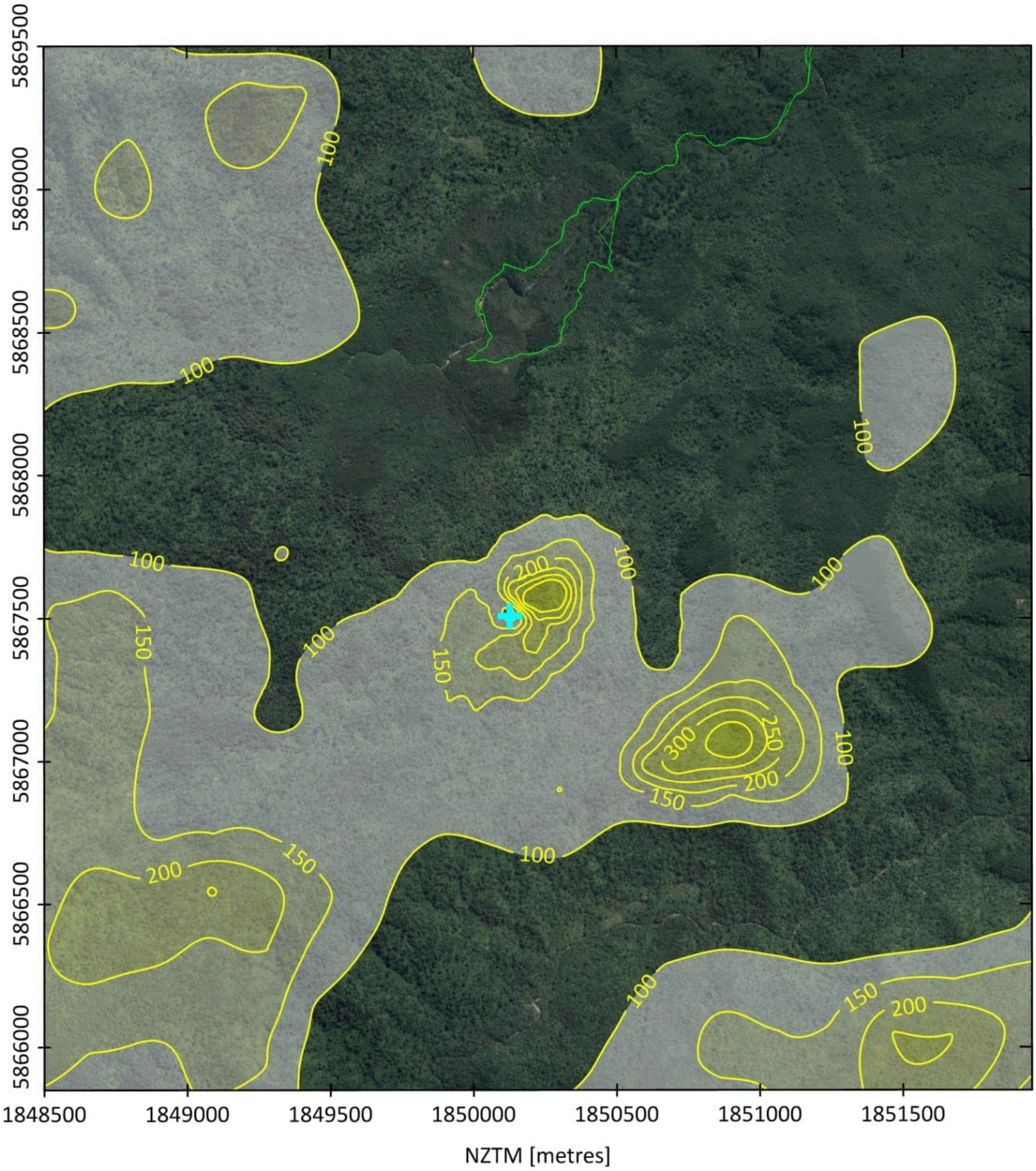


Appendix C Figure 1: CALMET domain showing terrain heights derived from Shuttle Radar Topography Mission (SMRT) 30 m resolution data. Vent location shown as blue crosshair.

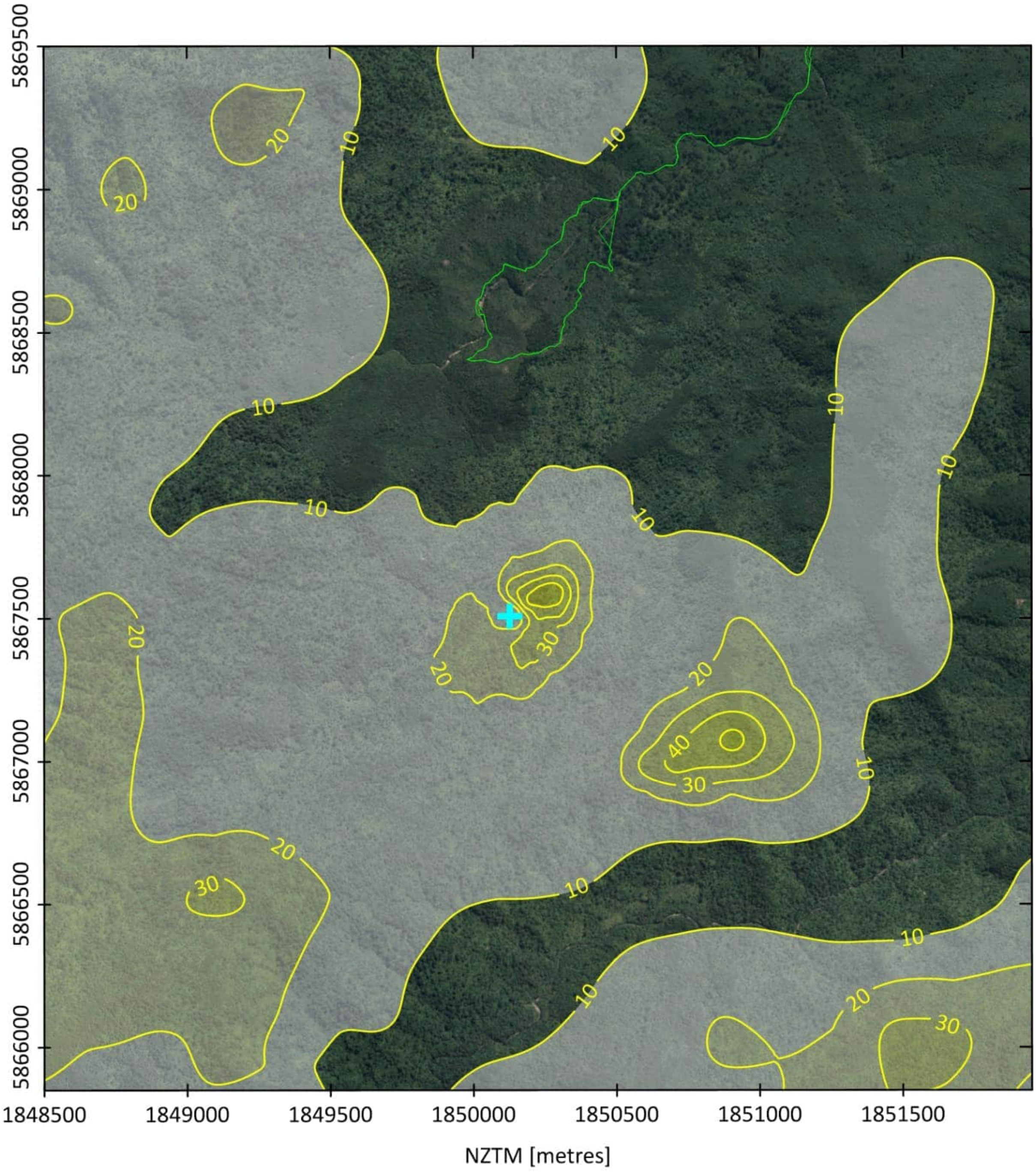


Appendix C Figure.2: CALMET domain showing land use categorisation derived from New Zealand Land Cover Database (LCDB) version 5. Vent location shown as blue crosshair.

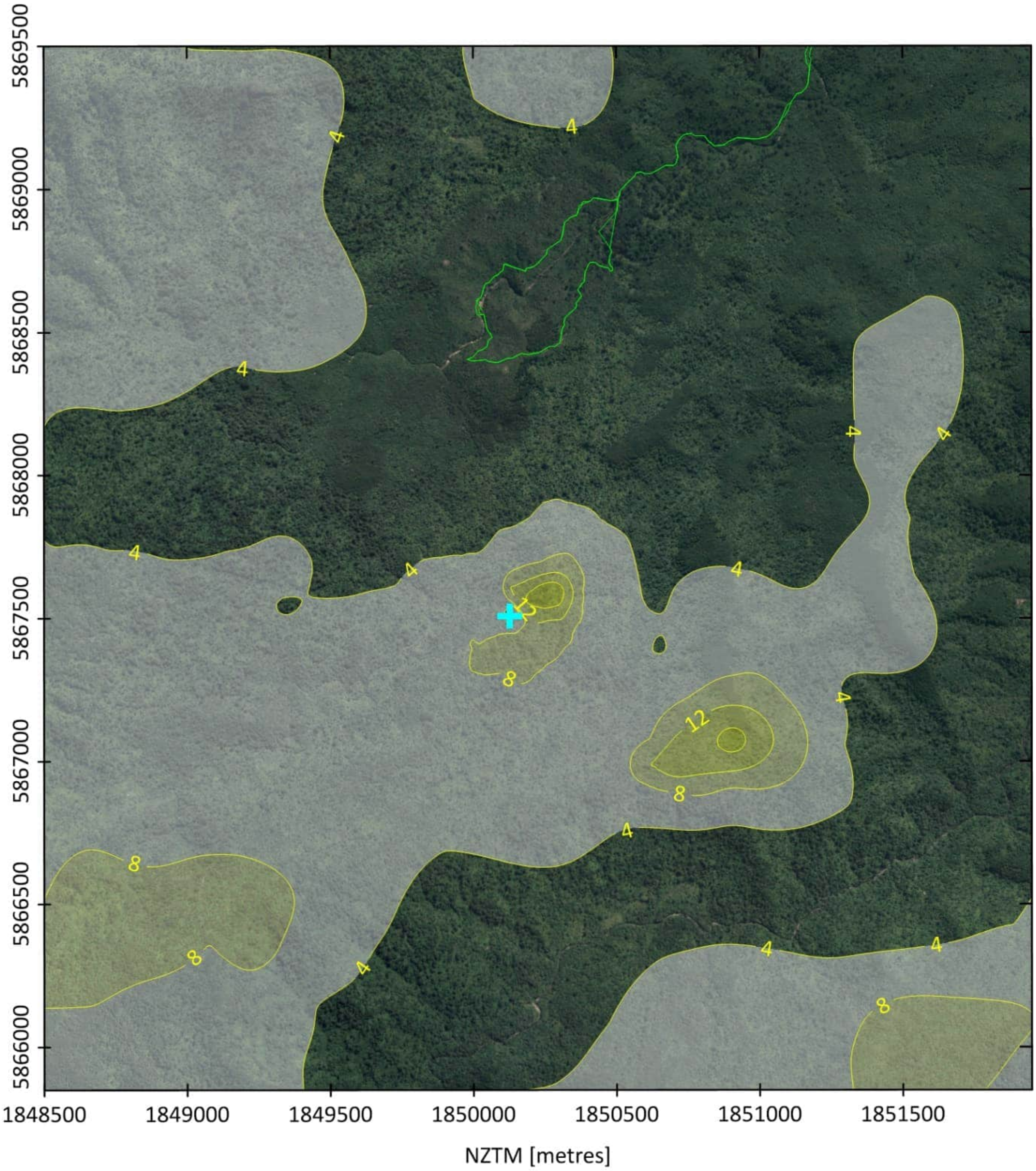
Appendix D Contour plots for ANFO detonation



Appendix D Figure 1: Predicted maximum 1-hour average CO concentrations excluding background



Appendix D Figure 2: Predicted maximum 1-hour average NO_X concentrations excluding background



Appendix D Figure 3: Predicted maximum 1-hour average NH_3 concentrations excluding background

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Appendix I Mine Safety Bulletin

Department of Consumer and Employment Protection
Government of Western Australia

Resources Safety

Mines Safety Bulletin No. 75

Date: 10 January 2006

Subject: Fire and explosion in a working party magazine

This bulletin is issued following extensive investigation, technical review and test-work relating to a fire and subsequent explosion that occurred in a working party explosives magazine underground at a mine with sulphide mineralisation during 2005.

Incident

At about 5.45 am, a fire behind the locked gates of a working party magazine was observed by underground personnel who were passing the area. Attempts were made to put out the fire using Dry Chemical Powder (DCP) fire extinguishers, but these attempts were unsuccessful.

It was estimated that in excess of six tonnes of explosives and between 1,500 and 3,000 detonators were stored in the working party magazine at the time of the fire.

Five people were able to escape from the mine through the decline portal entrance while a further 22 personnel, who were unable to use this means of egress, travelled to fresh-air bases and refuge chambers underground where they were all accounted for. Once accounted for, the personnel were moved to the shaft plat in preparation for evacuation from the mine.

Delays occurred in evacuating personnel through the shaft, as it was in transition from shaft sinking to equipping the production winding system. This necessitated the completion of a risk analysis so that the sinking kibble could be safely used for the evacuation of personnel.

About two hours after the fire was identified an explosion occurred which knocked out the underground communications. The explosion also stopped two surface fans for a brief period until they could be restarted.

Injuries

Four people in the vicinity of the working party magazine, who attempted to fight the fire, suffered smoke inhalation. No personnel suffered any serious injuries during the emergency evacuation from underground. The potential for serious consequences is, however, obvious.

Causes

The cause of the ignition in the magazine was not determined with certainty due to the damage sustained. However, the following contributory factors were evident as a result of investigation, technical review and testing:

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- Reactive mineralisation, containing sulphide material including pyrite and chalcopyrite, was present in the rock in which the magazine was excavated. Marcasite was also identified — a material that could react with ammonium nitrate in the explosive stored in the magazine and cause self-ignition as a result of the chemical reaction.
- ANFO was known to have spilled in the magazine prior to the incident. ANFO is known to interact with sulphides to cause an exothermic reaction. The chemical reaction may have a long induction period with little observable temperature increase. However, once sufficient catalysing species have built up, the reaction rate increases rapidly, generating sufficient heat to cause self-ignition.
- Ammonium nitrate is also an oxidising agent, which evolves its own oxygen during chemical reaction. This made it impossible for the dry powder fire extinguishers to smother the fire. Water application is the primary suppression method recommended in explosives manufacturers' material safety data sheets.
- A number of empty 500 kg bulk ANFO bags were allowed to accumulate in the magazine, stacked in close proximity to full ANFO bags. This would have provided an additional fuel source and assisted in the propagation of the fire.
- A number of personnel authorised to enter the working party magazine were found to be smokers and routinely carried cigarettes and lighters into the magazine. However, there was no evidence from witness statements or previous inspections and audits that personnel had been smoking inside or in the vicinity of the magazine immediately prior to the incident.
- The working party magazine was being utilised to supply several jumbo development headings concurrently. Consequently, a quantity of explosives in excess of six tonnes was being stored in one area for this purpose.
- There was no regular shift supervisory inspection carried out in the working party magazine on the shift the incident took place or on the shifts immediately prior to the incident.
- The explosives management plan for the mine did not detail the storage requirements mandated by legislation and regulation.
- The explosive management plan required weekly contractor inspections and monthly principal employer audits of magazines. Records revealed that the inspections and audits were not being carried out at this frequency.
- Dry chemical powder fire extinguishers were provided both inside and outside of the locked gates of the magazine. Personnel were not able to use these extinguishers due to their proximity to the fire. Fire extinguishers were sourced from mobile equipment to fight the fire.
- There was no water hose provided outside the locked magazine. The water hose inside the magazine could not be utilised when fighting the fire as the smoke had become too intense by the time the gate was unlocked.
- The area was force ventilated using a compressed air fan. The direction of the ventilation hampered attempts to put out the fire.

Consequences

- Personnel involved in fighting the fire suffered from smoke inhalation. They did not don their self rescuers but were able to quickly reach fresh air in the main decline after their attempts to extinguish the fire failed.
- The fire and subsequent explosion caused significant damage to services, ventilation doors and machinery up to a kilometre away. Communications were lost underground as a result of damage to the leaky feeder during the explosion. Communications were re-established after half an hour using hand held line-of-sight two way radios, which were brought down the shaft.
- The location of the working party magazine and the siting of force ventilation fans serving an adjacent, blind incline development heading were such that a jumbo operator wearing a self-rescuer had to

retreat about one kilometre through smoke towards the entrance to the heading, which was directly opposite the magazine where the fire and subsequent explosion took place. The person was retrieved by the brave action of a fitter who returned underground in a light vehicle and had to pass close by the magazine on two occasions to effect the rescue.

Comment

- The working party magazine concept, historically, was created to provide for local storage of small quantities of explosives and detonators for the use of one airleg miner or a small group working in a particular area.
- With the advent of jumbo development, the quantities stored in working party magazines have generally increased from a nominal quantity of about 100–200 kg up to quantities in excess of one tonne. Where dedicated jumbo development crews and charge up crews are established, the quantities of explosives and detonators required to serve the multiple areas being developed, can lead (without appropriate controls) to even greater tonnages being stored in a so-called working party magazine. The regulatory provisions, as they were originally developed, did not envisage catering for the levels of usage occurring today.
- A working party magazine should only be utilised to provide small quantities of explosive for an individual or a small work group, and the concept should not be used for the large-scale storage and supply of explosives to service extensive jumbo development or multiple stope face blasting. Large quantities of explosives needed for such working methods should be supplied from a main magazine underground or directly from a surface magazine if this is feasible.

Preventative action

- Mines with reactive sulphide orebodies or stringers should develop a comprehensive management plan to adequately deal with the hazards potentially associated with reactive ground:
    - The geology should be examined on a regular basis to determine the potential for the presence of reactive ground.
    - A geological plan should be maintained identifying areas where sulphides or reactive ground is present.
    - Explosives sensitive to reactive ground should not be used or stored in those areas identified as having reactive ground present. Comprehensive inspections and risk assessments should be completed to affirm that explosive storage areas are free from the presence of sulphide material or reactive ground.
    - Specialised inhibited explosives designed for use in reactive ground should be sourced and appropriately used where sulphide material or reactive ground may present a hazard.
    - Inspection, monitoring and suppression methods should be implemented to mitigate or remove the potential hazards associated with reactive ground, such as sulphide dust explosions or spontaneous combustion catalysed by extraneous materials such as explosives or fuels.
- A comprehensive procedure for the storage, transport and usage of explosives needs to be developed for each operation, in accordance with legislation, regulatory provisions and applicable standards.
- The statutorily appointed managers who have the daily control and supervision of the mine (Registered Manager and Underground Manager) need to ensure that a system is established to verify that shift inspections are being completed by supervisory staff in all working areas underground, including explosive magazines in accordance with regulations 3.18 and 3.21.
- The statutorily appointed managers who have the daily control and supervision of the mine (Registered Manager and Underground Manager) need to ensure that a system is in place to verify that inspections and audits laid down in company procedures are being completed at the prescribed frequency.

- A procedure to deal with the accumulation and removal of empty ANFO bags or spillage in an explosives magazine needs to be included as part of the storage requirements in any explosives management plan. Prior to removal from the mine once empty, the ANFO bags should be cleaned and stored outside the magazine and a safe distance from the explosives to reduce the fire risk hazard. All spillage should be cleaned up and removed immediately.
- Procedures should be developed to ensure that no personnel smoke or take contraband (e.g. lighters, matches, mobile phones, radio transmitters) inside the detonator or explosive magazines. This should be reinforced at periodic retraining sessions for personnel with access to explosives.
- A water deluge system and fire hoses should be provided at all storage areas where large quantities of explosives, in particular ANFO, are stored. The activation mechanism for the water deluge system should preferably be automatic or otherwise should be accessible from outside the locked magazine. Fire hoses and water should also be similarly installed outside the entrance to magazines.
- Fire extinguishers need to be placed a safe distance from the explosive storage area so they can be safely utilised in an emergency.
- Working party magazines need to be sited clear of entrances to currently working development headings and their air intakes so that, in the event of a fire, personnel can retreat to safety without being exposed to the hazards potentially arising from a fire or explosion associated with the magazine.
- Back up communications in the form of a direct telephone system underground should be considered in addition to any leaky feeder system. The installation of the back up communication should be such that it is connected via a separate route to avoid both sets of communications being damaged by a fire or explosion in any one area.
- Personnel need to be adequately trained, retrained and regularly reminded of the importance of donning self-rescuers where a fire is evident underground. Once donned, personnel should not attempt to fight the fire but should immediately evacuate the area and proceed to a fresh-air base or refuge.

Further guidance

The Department has previously issued *Safety Bulletin No. 1: Sulphide Dust Explosion Hazard* and a *Guideline on the Safety Management of Underground Combustible Sulphide Dust*, which mine operators should review and implement where a similar hazard is evident. Both documents are available on the Department's website at www.docep.wa.gov.au/ResourcesSafety in the mining section, under guidance material and publications.

Mines should also conform to Australian Standard AS 2187.1:1998 — Explosives Storage Transport and Use — Part 1 in Appendix H, which recommends in part that magazines should be located clear of sources of sulphide dust.

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Appendix J Qualitative risk analysis

The risk assessment for the Willows Road portal entrance and WUG uses the qualitative rating of likelihood and consequence presented in **Appendix J Table 1** and **Appendix J Table 2** below.

Appendix J Table 1: Qualitative rating of likelihood[A]

Frequency rating	Descriptor	Explanation
A	Very Likely	Almost certain or expected to occur if all conditions met
B	Likely	Good chance that it might occur under normal operating conditions
C	As likely as not	Might or might not occur depending on conditions
D	Unlikely	Could occur but is not expected to occur under normal operating conditions
E	Improbable	Theoretically possible, but extremely remote chance of occurrence.

A. Adapted from Table 3 "Likelihood qualitative descriptors", Risk Assessment Methodology for Hazardous Substances, EPA, January 2020

Appendix J Table 2: Qualitative rating of consequence[A]

Effect rating	Descriptor	Spill to environment	Human health or property
1	Insignificant	Negligible environmental damage	No injuries
2	Minor	On-site release contained	First aid treatment required, minor damage to property
3	Moderate	Minor environmental damage	First aid treatment required, damage to off-site property
4	Major	Major environmental damage to immediate environment	Extensive injuries, moderate damage to off-site property
5	Catastrophic	Widespread environmental damage.	Fatalities both on and off-site, major exposure to toxic release by numerous people.

A. From AS/NZS 4360:1999

The likelihood and consequence ratings for each event are selected based on experience and judgement. These ratings are then combined to assess the overall level of risk associated with each hazard. The risk assessment matrix is shown in **Appendix J Table 3**.

Appendix J Table 3: Risk matrix[A]

Consequence / Likelihood	Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
	(1)	(2)	(3)	(4)	(5)
Almost certain (A)	Significant	Significant	High	High	High
Likely (B)	Moderate	Significant	Significant	High	High
Moderate (C)	Low	Moderate	Significant	High	High
Unlikely (D)	Low	Low	Moderate	Significant	High
Rare (E)	Low	Low	Moderate	Significant	Significant

A. From AS/NZS 4360:1999

Appendix J Table 4: Risk Assessment

Event	Controls (Mitigation/ Management Measures)		Residual risk assessment		
	Controls to reduce likelihood	Controls to reduce severity of consequence	Likelihood	Consequence	Risk
Unplanned detonation in explosives store (surface or underground store)	Adherence to WorkSafe requirements including the establishment of a certified Hazardous Substance Location prohibiting ignition sources and incompatible substances and ensuring the appropriate separation distances and fire protection systems are available. Strict security, access restriction and inventory monitoring for storage areas. Fire protection systems in place.	Store location selected for internal separation distance to off-site properties. Explosive quantity in each store reduced and separated by IMD to minimise risk of inter-magazine propagation. Appropriate design, testing, certification and maintenance of the explosives storage magazines surface) or chambers (underground) per the requirements of the HSW-HS. Segregated storage area for explosive substances, away from other hazardous substances and buildings. Emergency Management Plan will be in place.	Unlikely – explosives storage locations have high security, multiple ignition prevention and fire suppression systems in place	Minor (surface) Insignificant (WUG) – see quantitative assessment in Section 7.3.2.1 of this report.	Low
Fire in the ANE store (surface or underground)	Adherence to WorkSafe requirements including the establishment of a certified Hazardous Substance Location prohibiting ignition sources and incompatible substances. Strict security, access restriction and inventory monitoring for storage area. Fire protection systems in place.	Emergency Management Plan will be in place. Segregated storage area for ANE, away from other hazardous substances and buildings. Store location selected for internal separation distance to off-site properties.	Unlikely – ANE stores have restricted access and cannot accelerate fire without both an ignition source and combustible fuel.	Minor – Storage areas are well separated from any sensitive off-site receptors.	Low

Event	Controls (Mitigation/ Management Measures)		Residual risk assessment		
	Controls to reduce likelihood	Controls to reduce severity of consequence	Likelihood	Consequence	Risk
Container leak or rupture during unloading to site (any packaged substance - gasser, oils etc)	OGNZL to undertake regular audits of drivers/transport contractors to ensure compliance with the PHMP procedures. Transport of hazardous substances via truck in accordance with the Land Transport Rule: Dangerous Goods 2005, meeting requirements for packaging, labelling, loading restrictions, segregation of incompatibles, unloading inspections and recurrent training.	Spill kit, emergency showers and eye wash provisions (as applicable) in the unloading and storage areas, prompt movement of goods into dedicated bunded storage. Dedicated unloading areas draining to spill containment systems on site. Secondary containment provided in all liquid substance storage areas, SFA drains to treatment ponds and any liquid collected in the WUG is pumped to water treatment in Waihi.	Unlikely – Package failures or damage during transit are not uncommon, but requires failure of procedures and secondary and tertiary containment to result in release to the environment	Minor – The site unloading areas drain to the water treatment system, minimising the effect on the environment	Low
Diesel tank leak or rupture at storage location	Design, testing, certification and maintenance of the storage systems in accordance with standards set out in the HSW-HS and preventative maintenance will minimise the risk of leakage of hazardous substances.	Storage in double skinned tanks. Emergency Management Plan will be in place, including provision of spill kits and staff trained in spill response, and evacuation plans. Areas where diesel is stored drain to API oil water separators to remove any residual hydrocarbons in stormwater.	Unlikely – multiple failures of structural controls required to result in discharge to the environment.	Minor – any release contained in secondary containment or waste systems on site	Low
Spill of diesel during refuelling of equipment	Design, testing, certification and maintenance of the refuelling equipment in accordance with standards set out in the HSW-HS and preventative maintenance will minimise the risk of failure of refuelling equipment. OGNZL to undertake regular audits of drivers/transport to ensure compliance with the PHMP procedures.	Emergency Management Plan for Hydrocarbon Management in place, including spill response. Secondary containment in refuelling areas. Areas where refuelling occurs drain to API oil water separators to remove any residual hydrocarbons in stormwater.	As likely as not – These events are not uncommon, but requires failure of procedures to result in release to the environment.	Minor – The refuelling area drain to API separators, minimising the effect on the environment	Moderate

Event	Controls (Mitigation/ Management Measures)		Residual risk assessment		
	Controls to reduce likelihood	Controls to reduce severity of consequence	Likelihood	Consequence	Risk
Fire in a diesel tank area	Design, testing, certification and maintenance of the tanks, pumps and systems in accordance with standards set out in the HSW-HS. Prohibition of ignition sources and incompatible substances at the storage areas.	Separation distances to other buildings, hazardous substances or sensitive locations. Fire protection systems in place, drills held regularly. Emergency Management Plan will be in place, including fire fighting provisions and evacuation plans.	Unlikely – tank areas prohibit ignition sources and diesel is only combustible	Minor – storage areas above and below ground provide large separation to sensitive receptors, limited damage to on site property	Low
Fire in flammable or oxidising gas storage areas at the workshop	Prohibition of ignition sources and incompatible substances at the storage areas. Secure storage with chain restraints to prevent cylinder damage.	Separation distances to other buildings, hazardous substances or sensitive locations. Small inventory of flammable and oxidising gases maintained. Fire protection systems in place, drills held regularly. Emergency Management Plan will be in place, including fire fighting provisions and evacuation plans.	Unlikely – gas cylinder storage areas prohibit ignition sources and incompatible materials	Minor – workshop storage is provided large separation to sensitive receptors and other hazardous substance stores, limited damage to on site property	Low

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