Blasting Risk Assessment

for

Gunns Limited
Proposed Pulp Mill Development Site, Tasmania

Revision 5 – March 2006

Angelo Labriola
Orica Quarry & Construction Services

Contents

Blasting Risk Assessment – Gunns Longreach Pulp Mill

1. Introduction

Gunns Ltd has engaged Orica to conduct a risk assessment for proposed blasting activities associated with the construction of the Longreach Pulp Mill development, at Longreach, Tasmania.

The proposed blasting works extend over a wide area adjacent to the current milling area. The total amount of material requiring excavation is approximately 2.4Mbcm, of which only about 0.8Mbcm is expected to be free-dig material. The maximum depth of cut is expected to be between 80mRL to 60mRL.

The project will involve a series of blasts to be conducted to break all the required material to the correct depth. While the proposed blasting area is generally in the open or scrub/bush area, potential effects to structures, particularly the electricity transmission towers and poles to the immediate north and east of the proposed blasting area, must be assessed and properly managed.

Orica has been asked to assess the impacts of blasting, including the risk of damage to surrounding structures and utilities.

2. Geology

The area is predominantly underlain by the Jurassic Dolerite. Geotechnical drilling confirmed that all boreholes in the proposed development area intersected extremely weathered to fresh Jurassic Dolerite. The weathering profile is highly variable, with weathering generally focussed along joint and fracture planes. As the Dolerite grades to highly weathered near the surface, sand, silty clay and clayey sand are also found to occur. (*ref: BFP Consultants Pty Ltd, April 2005; Pulp Mill Longreach Geotechnical Investigation*)

3. Risk Assessment Process

In conducting the risk assessment, blasting effects that can impact on surrounding structures were listed and assessed according to their potential likelihood and potential consequence. These are ground vibration, airblast, flyrock and ground dislocation. Once assessed, a number is assigned to each event and the risk calculated by multiplying the two numbers. The events are analysed, elimination measures are suggested and the risk re-calculated based on the measures being adopted.

3.1 Ground vibration

Each structure that could potentially be affected by ground vibration was assessed based on its construction, purpose and Orica's blasting experience. For residential and commercial areas/structures, the guidelines provided in the Australian Standard AS 2187.2 – 1993 have been used. It should be noted that these guidelines have been established based on *ground* vibration levels at the point of interest, and that they relate to peak particle velocities for human comfort, as opposed to levels that would necessarily cause damage to structures.

Accordingly, the AS 2187.2 – 1993 guidelines have been adopted for areas where the general public are housed or work. For other structures where human comfort vibration levels are less relevant, Orica has used its experience in a wide array of construction applications to determine the levels of risk based upon higher peak particle velocity vibration levels. Examples of such structures include the power poles and high voltage transmission towers.

The Australian Standards recommendations for peak vibration levels for human comfort are summarised in Table 3.1 below.

Table 3.1: Australian Standards (AS2187.2), recommended maximum peak particle velocities for human comfort.

Type of building or structure	Peak particle velocity – mm/s
Houses and residential buildings or structures.	10
Commercial and industrial buildings or structures.	25

The ground vibration attenuation estimation formula that has been used in the absence of site-specific measurements and calibrated models is also derived from AS2187.2 – 1993, and is outlined below:

$$GroundVibration(mm/s) = 1140\left(\frac{R}{\sqrt{Q}}\right)^{-1.6}$$

Where R = distance to point of concern (m)
Q = charge mass per delay (kg)

The formula for vibration is a theoretical approach and actual results will be influenced by local geology, blast orientation, weather conditions and blast monitor set-up.

It is recommended that vibration and airblast be measured on an ongoing basis, with regular reviews of results being used to modify blast parameters. This will allow modification of blast design parameters to optimise cost and operating efficiencies while maintaining control of environmental factors.

3.2 Airblast

Each structure likely to be effected by airblast was assessed based on its construction and Orica blasting experience.

Due to the blasting methods to be employed, and the nature of the structures surrounding the site, airblast will be below levels that may cause damage. Human perception is sensitive to airblast levels though, and it is therefore suggested that airblast be monitored in the vicinity of the residents at the township of Rowella to allow designs to be tailored to minimise potential disturbance to residents.

3.3 Flyrock

Flyrock poses the greatest risk when blasting close to structures, and in particular to the overhead power transmission lines and fibre optic cable. It is the phenomenon that is most likely to cause damage or injury.

In critical areas very close to the power lines and transmission towers, additional ground cover material may be required to ensure that there is no potential for damaging flyrock.
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3.4 Ground dislocation

As rock is blasted it will create dislocations in the surrounding rock that may affect structures that are extremely close. The only known structures that are in close enough proximity to be potentially affected by ground dislocation are the wooden power poles that are due to be upgraded to dual circuit @ 22kV, and which also support a suspended fibre optic cable.

It is expected that ground dislocation potential can successfully be managed, using techniques such as small diameter blastholes, shorter charge lengths, and potentially decked charges.

4. Site layout

The site and its proposed plan layout are shown in Figure 4.1 and Photo 4.2. Figure 4.1 shows a plan view of the proposed pulp mill site, while Photo 4.2 shows an overhead view of the site taken from a rotated angle. This photo shows the site in its present condition.

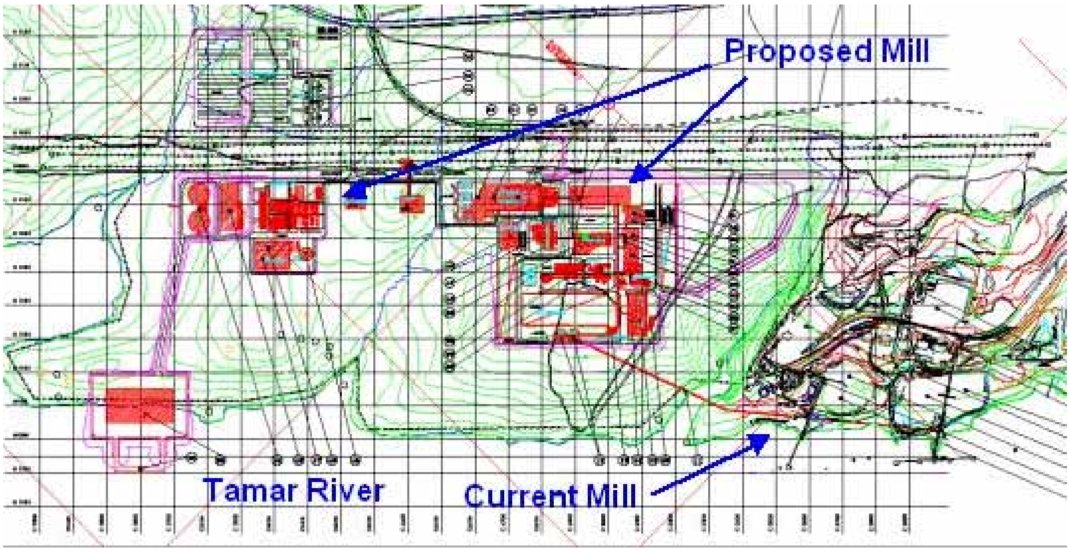

Figure 4.1: Plan view of the proposed Pulp Mill site

Photo 4.2: Current site layout

The numerics in Photo 4.2 indicate the following:

1	Current Plant, facilities and offices
2	Corridor containing power poles and power transmission towers
3	Existing Power Plant
4	The township of Rowella (on opposite bank of the river)
5	Main Highway

The township of Rowella is located on the opposite side of the river. This is the closest area with public residents, and is therefore a sensitive region for the project. Maintaining strict control of airblast and flyrock will be a critical requirement for residents in this area. Photo 4.3 shows an aerial view of the proposed project site, with the township of Rowella visible on the opposite end of the river.

Photo 4.3: Proposed plant location in the foreground, with the township of Rowella on the opposite side of the river

The structures that are expected to be most sensitive to blasting are the power lines, and in particular, the power lines and optic fibre cable suspended from the wooden power poles. This is because the proposed area to be excavated extends to as close as 5m from the base of these power poles.

A schematic cross-section of the transmission line corridor is shown in Figure 4.4. The cross section is drawn looking towards the north-west.

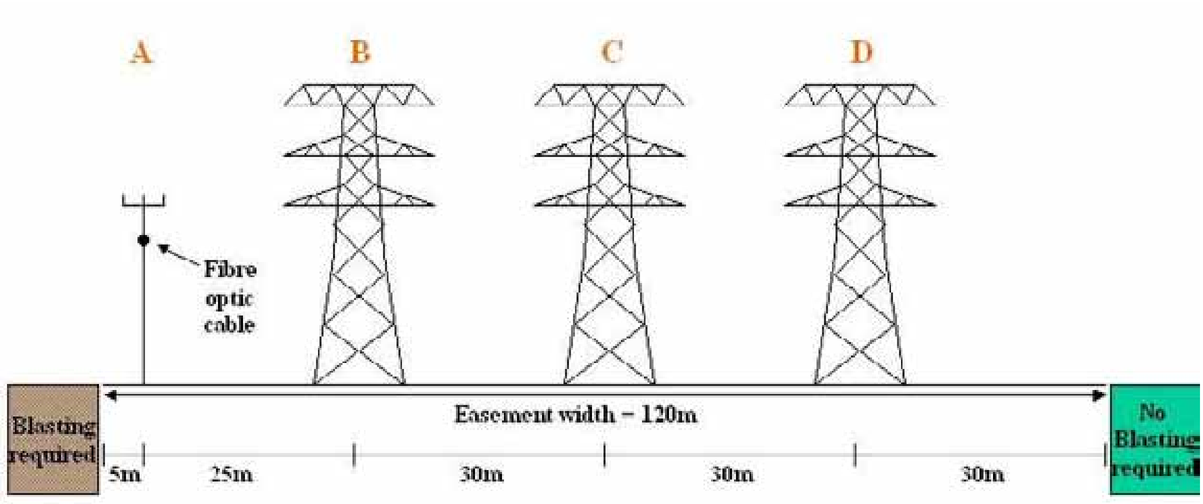

Figure 4.4: Cross section of transmission line corridor with approximate distances between towers/poles and the edges of the corridor boundaries

A summary description of each pole/tower in Figure 4.4 is as follows:

A Currently a single circuit 22kV line, supplying Beaconsfield Gold only.
Has a fibre optic cable suspended from the pole.
May be operational at first, but not for most of the construction phase.
Will be upgraded to a double circuit 22kV line
Will be operational again at the end of the construction phase.
The fibre optic will remain operational for the duration of the works.

B & C Each tower is a double circuit 220kV transmission tower.
They are part of the Transend power grid, connecting to the Bell Bay sub.
These cables connect the Bell Bay sub to the rest of the State of Tasmania.
Basslink will connect to the Bell Bay sub.

D Currently contains two 22kV lines, currently both supplying the mill.
After construction begins, one line will temporarily supply the mill.
Second line will supply from project site to Beaconsfield while A is upgraded.
This tower will be converted to a single 220kV line, for long-term mill supply.
Tower will be operational at the start of the construction phase of the project.

5. Structures & locations close to the blast site

The following is a compilation of structures or points of interest surrounding the blasting area. An assessment of the potential for airblast and flyrock has been made for each, along with an estimation of the resultant ground vibration level using the formula outlined in Section 3.1.

Photo 5.1 on the following page shows an aerial view of the site and its surrounds, with the Location positions referred to in the remainder of this document indicated.

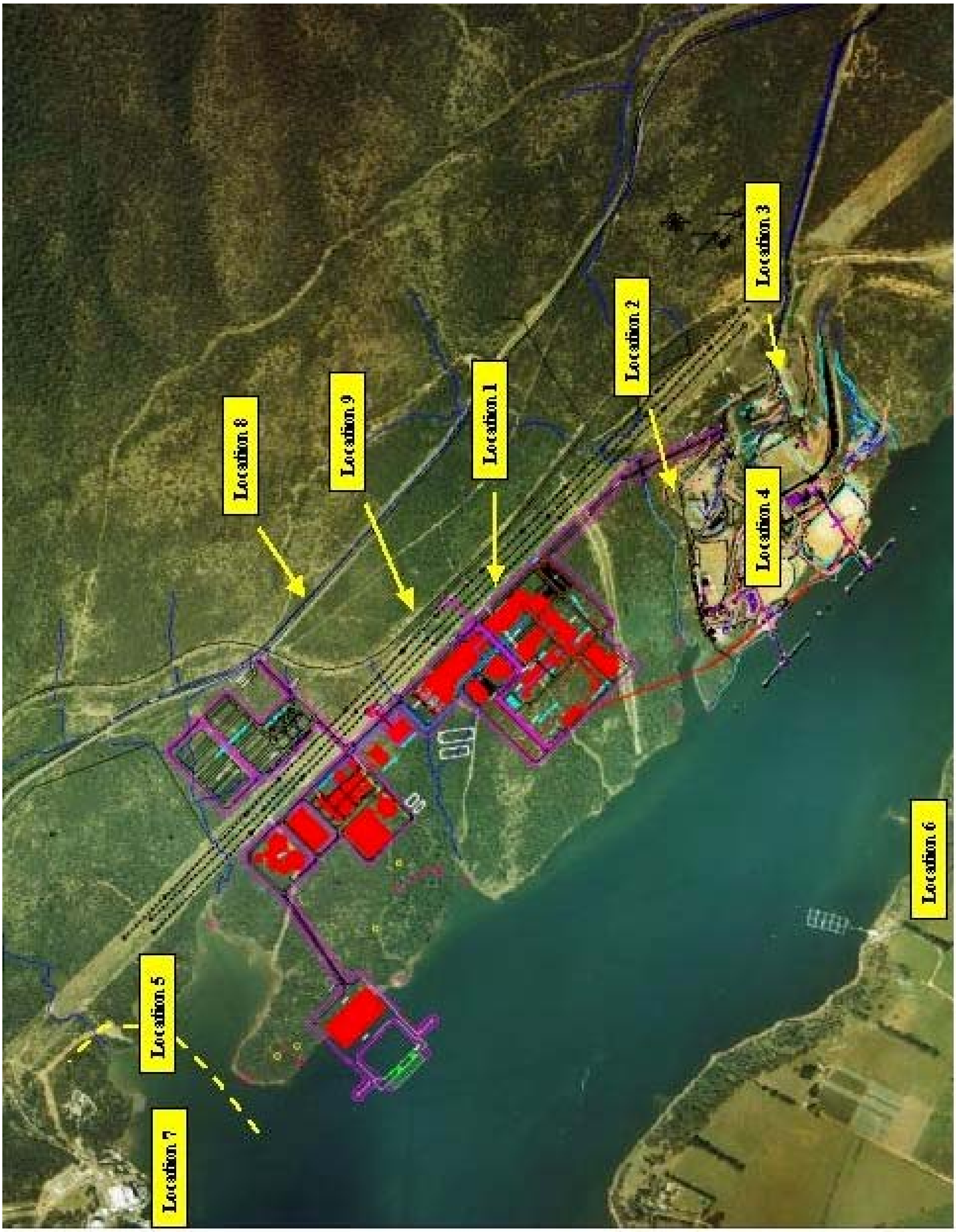

Photo 5.1: Aerial view of proposed site and surrounds, with locations of interest referenced in this report indicated

5.1. Location 1: Power poles and Transmission Towers

The power line corridor towards the north and east of the proposed plant is the most sensitive structure for blasting operations. A view looking south-east is shown in Photo 5.1.1.

Photo 5.1.1: Power transmission corridor – looking south-east

It is planned to conduct blasting up to 5m of the exiting 22kV power poles with attached fibre optic cable. For the purposes of this report, the risk assessment is focussed on these power poles, as the transmission towers are further away and at greater elevation from blasting activities. Of the four sets of power lines, it is the existing 22kV power poles that are the most sensitive. Consequently, any measure to prevent these poles from being damaged by these blasting operations will also provide appropriate protection to the transmission towers. A closer view of the power pole is provided in Photo 5.1.2.

Photo 5.1.2: Existing 22kV power pole with fibre optic cable attached beneath the power lines

Based on prior experience, it is expected that a ground vibration level of 150mm/s can be tolerated by the power pole, particularly at high frequencies. It is, however, suggested that test blasting be conducted with single holes drilled at 5m from the power poles, to measure vibration and observe the effects to ensure that the power lines do not sway to greater than acceptable levels during blasting. To achieve these limits for ground vibration, the charge designs will need to be modified according to distance from the power poles.

For 5 – 10m from power poles, the nominal design in Table 5.1.1 may apply:

Bench height	2.5 m
Subdrill	0.5 m
Stemming	2.0 m
Blasthole diameter	64 mm
Explosives type & mass per cartridge	Powergel Magnum 45x400mm; 735g
Charge mass per blasthole (maximum)	1.84 kg
Allowable Maximum Instantaneous Charge (MIC). • Calculated PPV @ 5 m • Calculated PPV @ 10m	 141 mm/s 47 mm/s

Table 5.1.1: Nominal charging parameters for 5 – 10m from power poles in the power transmission corridor

For 10 – 20m from power poles, the nominal design in Table 5.1.2 may apply:

Bench height	5.0 m
Subdrill	0.5 m
Stemming	2.3 m
Blasthole diameter	64 mm
Explosives type & mass per cartridge	Powergel Magnum 45x400mm; 735g
Charge mass per blasthole (maximum)	5.88 kg
Allowable Maximum Instantaneous Charge (MIC). • Calculated PPV @ 10 m • Calculated PPV @ 20m	 118 mm/s 39 mm/s

Table 5.1.2: Nominal charging parameters for 10 – 20m from power poles in the power transmission corridor

As distances from the power poles increase, ground vibration frequencies are expected to lower. A limit of 100mm/s may be conservatively applied at greater distances. Bulk emulsion explosives may be used at these greater distances. A 100mm/s limit results in the following calculated charge weights according to distance from power poles:

- 19.1kg @ 20m
- 43kg @ 30m
- 76kg @ 40m
- 119kg @ 50m
- 172kg @ 60m

Note that the parameters outlined above represent nominal designs only. Based on project and drilling economics, it is possible to vary blasthole diameter, length and even deck charges if necessary while maintaining control of maximum peak particle velocity.

It is critical that the blastholes in shots fired in close proximity to the power lines are initiated in such a manner that delivers guaranteed single hole firing. Given the sensitivity of the structures and their close proximity, electronic delay detonators are recommended to ensure control of the maximum instantaneous charge (MIC).

Although this report was originally written assuming all power lines are live, it is now understood that the closest power lines (22kV) will be de-commissioned during the blasting activities adjacent to them. This further reduces the risk.

Other Blasting Effects

- Ground dislocation damage to power poles is not expected, based on the nominal designs

- Flyrock is expected to be contained with the nominated stemming heights. Extra ground cover may be used for greater assurance where it is observed that collar rock strength is low. Approximately 1.5m maximum additional ground cover is expected to be sufficient to prevent flyrock damage potential.

- To ensure that the design parameters are appropriate and provide adequate protection against flyrock, it is recommended that the blast design for close proximity to power lines be trialed in a region that is further removed from these facilities. All blasts in close proximity to critical structures should be filmed on video.

- The residents at Rowella are more than 2400m away from blasting activities adjacent to powerlines. Airblast can successfully be controlled by the nominated stemming lengths and hole-by-hole initiation.

5.2. Location 2: Power lines near access road and water tank

A line of power poles providing electricity to the office and administration area of the present site, is located near the access road, water tank and electrical substation. The power lines are shown in Photo 5.2.1.

Photo 5.2.1: Power lines near present access road to site offices and near water tank

Aside from the main plant construction area to the north-west of this power line, blasting is also likely to be conducted for an access road to the proposed plant, just to south-east of this power line. Since the power line is in close proximity to the current access roads and other structures, the AS2187.2 recommendation for blasting close to commercial structures (PPV = 25mm/s) has been adopted.

- Power line to main plant site blasting area >= 500m
- Power line to access road blasting area >=100m

A nominal charge design for blasting works is outlined in Table 5.2.1.

Bench height	10.0 m
Subdrill	0.8 m
Stemming	2.5 m
Blasthole diameter	102 mm
Bulk Explosive type & density	Handibulk Supawet; 1.2g/cc
Charge mass per blasthole (maximum)	81.4 kg
Allowable Maximum Instantaneous Charge (MIC). • 25mm/s @ 100 m • 25mm/s @ 500 m	 84 kg 2110 kg

Table 5.2.1: Nominal charging parameters for blasting works in the vicinity of the power lines near the present access road and water tank

Other Blasting Effects

- Ground dislocation damage is not expected, based on the distances involved.
- Flyrock is expected to be contained using appropriate stemming lengths.
- There are no airblast concerns for the power line in this location.

5.3. Location 3: Water tank, electrical substation and localised underground services near access road

A water tank and electrical substation are located near the current access road to the site administration area. The substation affects power to the site only, and not to external users. Signs indicate the location of underground services in the area as well. It is understood that the underground services do not extend beyond the current fence line towards the proposed areas of blasting (*Stanford, Greg; Personal communication*). The water tank and substation are shown in Photos 5.3.1 and 5.3.2 respectively, while a sign indicating underground services adjacent to the fence line is shown in Photo 5.3.3.

Photo 5.3.1: Water tank near access road to site

Photo 5.3.2: Electrical substation near access road to site

Photo 5.3.3: Signage indicating local underground services near the access road area

For ground vibration evaluation purposes, the water tank and electrical substation have been assigned a PPV of 25mm/s, in accordance with the AS2187.2 recommendation for blasting close to commercial structures or industrial buildings. The underground services are also conservatively assigned 25mm/s, as the type of piping and burial details are unknown.

- Tank and substation to main plant site blasting area >= 700m
- Tank and substation to access road blasting area >=25m

A nominal charge design for blasting works at the main plant site is outlined in Table 5.3.1.

Bench height	10.0 m
Subdrill	0.8 m
Stemming	2.5 m
Blasthole diameter	102 mm
Bulk Explosive type & density	Handibulk Supawet; 1.2g/cc
Charge mass per blasthole (maximum)	81.4 kg
Allowable Maximum Instantaneous Charge (MIC). • 25mm/s @ 700 m	4135 kg

Table 5.3.1: Nominal charging parameters for blasting works at the main plant site and the calculated maximum charge weight for the water tank and electrical substation location

- The allowable Maximum Instantaneous Charge weight (MIC) for the new access road works located approximately 25m from the substation and tank site is 5.27kg. This will require smaller diameter holes (eg 64mm) and packaged emulsion explosives to charge.

<u>Other Blasting Effects</u>

- Ground dislocation damage is not expected, based on the distances involved.

- Flyrock is expected to be contained using appropriate stemming lengths. Extra precautionary cover may be used for blasting the access road close to the electrical substation.

- There are no airblast concerns for the water tank and substation.

5.4. Location 4: Offices, car park and present plant facilities

The existing office and plant facilities are located to the south of the proposed new plant site. They predominantly consist of the present mill site, offices car parks, and loading facilities. Photo 5.4.1 shows the upper level site office building.

Photo 5.4.1: Upper level site office building

For purposes of this report, the current office and plant region has been assigned a PPV of 25mm/s, in accordance with the AS2187.2 recommendation for blasting close to commercial structures or industrial buildings.

- Current office and plant area to main plant site blasting area >= 300m

A nominal charge design for blasting works at the main plant site is outlined in Table 5.4.1.

Bench height	10.0 m
Subdrill	0.8 m
Stemming	2.5 m
Blasthole diameter	102 mm
Bulk Explosive type & density	Handibulk Supawet; 1.2g/cc
Charge mass per blasthole (maximum)	81.4 kg
Allowable Maximum Instantaneous Charge (MIC). • 25mm/s @ 300 m	760 kg

Table 5.4.1: Nominal charging parameters for blasting works at the main plant site and the calculated maximum charge weight for the current site and office facilities location

<u>Other Blasting Effects</u>

- Ground dislocation damage is not expected, based on the distances involved.
- Flyrock is expected to be contained using appropriate stemming lengths.

- The calculated airblast level using the MIC and minimum distance in Table 5.4.1 is 119dBL. Typical regulatory maximum airblast levels for human comfort are either 115dBL or 120dBL, depending on the governing authority for a given project. Airblast overpressure can be controlled by ensuring appropriate stemming and confinement.

5.5. Location 5: Buried gas pipeline

There is a mains gas pipeline submerged/buried to the north-west of the proposed pulp mill site. It crosses the Tamar River and then diverts to the north. The approximate river crossing points are shown in Figure 5.5.1. Pipelines have been proven to resist high levels of ground vibration, in the order of several hundreds of mm/s.

Figure 5.5.1: Blue arrows indicating the approximate river crossing points of the main gas pipeline

- Mains gas pipeline to proposed warehouse pad blasting area > 400m

Blasting Effects

- Blast vibration at >400m away from the pipeline are negligible based on what pipelines can withstand. Assuming an MIC of 81.4kg, the expected PPV is 2.64mm/s.
- Ground dislocation damage would not occur based on the distances involved.
- Flyrock – N/A

5.6. Location 6: Rowella Township and Fish Farm

The township of Rowella is situated on the opposite bank of the Tamar River from the proposed pulp mill site. A view of the location of the township and fish farm relative to the proposed pulp mill site is shown in Photo 5.6.1. Environmental considerations include potential blasting effects on the residents and dwellings/structures, as well as potential effects on the river and aquatic life, particularly at the fish farm.

Figure 5.6.1: Rowella township and fish farm, on the opposite bank of the Tamar River

A region of approximately 3 hectares of level ground is required at the warehouse site adjacent to the river. It is not certain that blasting will be required in this location. If so, the minimum distance to the required cut area is estimated to be approximately 30 metres from the river's edge, assuming high tide.

In accordance with AS2187.2 recommendations for blasting near houses and low-rise buildings, the maximum peak particle velocity relevant to the Rowella region is 10mm/s.

- Rowella township fish farm to main plant site blasting area >= 2400m
- Nearest house at Rowella to warehouse pad area 1200m
- Fish farm to warehouse pad area 1000m

A nominal charge design for blasting works at the main plant site is outlined in Table 5.6.1.

Bench height	10.0 m
Subdrill	0.8 m
Stemming	2.5 m
Blasthole diameter	102 mm
Bulk Explosive type & density	Handibulk Supawet; 1.2g/cc
Charge mass per blasthole (maximum)	81.4 kg
Allowable Maximum Instantaneous Charge (MIC).	
• 10mm/s @ 2400 m	15,463 kg
• 10mm/s @ 1200 m	3,865 kg

Table 5.6.1: Nominal charging parameters for blasting works at the main plant site and the calculated maximum charge weight for the nearest residence, which is located at Rowella.

The effect of blasting at the fish farm is not expected to be of concern due to the charge weight and distances involved. Nevertheless, the potential effect has been investigated based on available literature.

In October 2003, tests were conducted at the Red Funnel Terminal. Southhampton, to determine the effects of noise on fish due to piling operations (*ref: Nedwell, Dr. Jeremy, Turnpenny, Dr. Andrew, Langworthy, Mr. John, and Edwards, Mr Bryan; 2003. "Measurements of underwater noise during piling at the Red Funnel Terminal, Southhampton, and observations of its effect on caged fish." Subacoustech Ltd. Report Reference: 558 R 0207*)

Brown trout (*Salmo trutta*) were caged and located at various distances from the piling works. Measurements and observations were made to determine the effects on the fish. Vibratory pile drivers and impact pile drivers were used in the tests. The report concluded that there was no evidence of:

- Trout reacting to impact piling at the regulatory stand-off of 400m;
- Trout reacting to vibropiling even at close range (<50m);
- Gross physical injury to trout at the monitoring range of 400m

It should be noted that the cultured species in the Tamar River, *Salmo salar*, (Atlantic Salmon) is very similar to the *Salmo trutta* species evaluated in the aforementioned report (*Harding, Lawson; Personal communication*).

Calculating airblast using the methodology as that used for other points of interest in this report is not appropriate for the fish farm, as the methods in this report relate to overpressure travelling through air.

The type of impact pile driver used in the Red Funnel Terminal operation was a BSP 357/9 hydraulic top hammer. The diameter, hammer drop weight and drop height are unspecified in the report. Nevertheless, technical data on the BSP 357/9 pile driver (*obtained from Watson*

& Hillhouse – International piling equipment) shows that hammer weights range from 3 to 9 tonnes, and drop heights vary from 0.2 to 1.21m.

The on-line newsletter "Noise News" (published by *WS Atkins Noise & Vibration*, a division of WS Atkins plc), relates a series of empirical formulae for the calculation of peak vibration levels from pile drivers. Using all of these formulae and applying them to the maximum and minimum size configurations of the BSP 357/9 pile driver suggest that the pile driver produces between 19mm/s (3 tonne hammer, 0.2m drop height) and 292mm/s (9 tonne hammer, 1.21m drop height) at a distance of 1m from the pile. Based on the above calculations, a figure of 50mm/s is assumed for calculation purposes.

The main plant site blasting works are expected to be no less than 400m to the water's edge. At 400m, the expected peak particle velocity based on a maximum instantaneous charge mass of 81.4kg is 2.64mm/s. This is 7 times lower than the calculated minimum peak particle velocity that would have been produced by the pile driver in the Red Funnel Terminal study.

For the potential blasting works at the warehouse pad, a peak particle velocity of 50mm/s at the water's edge (a minimum 30m distant at high tide) would be produced by a maximum instantaneous charge weight of approximately 18kg.

<u>Other Blasting Effects</u>

- The ground vibration in the direction of Rowella at 2400m from the blast is expected to be 0.15mm/s.

- Ground dislocation damage is not expected, based on the distances involved.

- Flyrock is expected to be contained using appropriate stemming lengths.

- The calculated airblast level using the MIC and minimum distance in Table 5.6.1 is 98dBL. Typical regulatory maximum airblast levels for human comfort are either 115dBL or 120dBL, depending on the governing authority for a given project. It is expected that airblast overpressure can be controlled by ensuring appropriate stemming and confinement. It is critical that quality control be carefully controlled to ensure holes are not poorly stemmed or under-burdened.

Since the predicted vibration levels are low, the key risk to manage becomes flyrock, and to a lesser extent, airblast. Although well designed and contained blasts will not produce excessive flyrock, poor quality control, insufficient stemming, or insufficient burdens can produce conditions where rock fragments are projected up to several hundred metres.

A blasting management safety plan will be in place for blasting activities, and flyrock risk management should be included in the document. Risk mitigation measures for the prevention of flyrock include:

- Drilling accuracy and quality control in marking out patterns
- Appropriate blast design
- Careful consideration of face burdens. In critical areas, burdens must either be conservative or measured using face profiling and bore-tracking of front row holes.

- Quality control in achieving design stemming lengths
- Ensuring appropriate selection of stemming material and ensuring that stemming does not bridge when loading into the blasthole
- Measurement of charge column length and extraction of explosives where holes have been over-loaded.

5.7. Location 7: Power Station

There is a Power Station located on the bank of the Tamar River, to the north-west of the proposed pulp mill site. The power station is shown in Photo 5.7.1.

Figure 5.7.1: Power Station, north-west of the proposed site, on the bank of the Tamar River

In accordance with AS2187.2 recommendations for blasting near commercial and industrial buildings, the maximum peak particle velocity relevant to the Power Station is 25mm/s.

- Power Station to main plant site blasting area >= 1400m

A nominal charge design for blasting works at the main plant site is outlined in Table 5.7.1.

Bench height	10.0 m
Subdrill	0.8 m
Stemming	2.5 m
Blasthole diameter	102 mm
Bulk Explosive type & density	Handibulk Supawet; 1.2g/cc
Charge mass per blasthole (maximum)	81.4 kg
Allowable Maximum Instantaneous Charge (MIC). • 25mm/s @ 1400 m	 16,540 kg

Table 5.7.1: Nominal charging parameters for blasting works at the main plant site and the calculated maximum charge weight for the Power Station location

<u>Other Blasting Effects</u>

- The ground vibration in the direction of the Power Station at 1400m from the blast is expected to be 0.36mm/s.
- Ground dislocation damage is not expected, based on the distances involved.
- Flyrock is expected to be contained using appropriate stemming lengths.
- The calculated airblast level using the MIC and minimum distance in Table 5.6.1 is 103dBL. Typical regulatory maximum airblast levels for human comfort are either 115dBL or 120dBL, depending on the governing authority for a given project. It is expected that airblast overpressure can be controlled by ensuring appropriate stemming and confinement. It is critical that quality control be carefully controlled to ensure holes are not poorly stemmed or under-burdened.

5.8. Other locations & structures of interest

There are other structures of interest that surround the site. Of these, the most significant are:

- The Highway (Location 8)
- The Railway (Location 9)
- The fuel storage tanks at the access road to the current site workings
- Esk pipeline

Photos of these (excluding the Esk pipeline) are provided in Photos 5.8.1 – 5.8.3.

Photo 5.8.1: Main Highway, north and north-east of the proposed pulp mill site

Photo 5.8.2: Railway line, north and north-east of the proposed pulp mill site

Photo 5.8.3: Fuel storage tanks, south-east of the proposed pulp mill site

Each of these structures is further away from a structure of interest previously analysed in the report. The railway and highway are on the opposite side of the power transmission corridor, and as such, the designs and precautions taken for the power lines will also protect these structures. Blasting is expected to be conducted approximately 140m from the railway line. Using a maximum MIC of 81.4kg, the calculated PPV is 14.2mm/s.

The fuel storage tanks are located further south-east of the water tank and substation near the access road. The designs used to ensure that the water tank and substation are protected will therefore be suitable for the fuel storage tanks.

The Esk pipeline is located at least a further 300m beyond the railway line. Assuming a maximum MIC of 81.4kg, the calculated PPV is approximately 2.3mm/s. It is noted that the pipeline was constructed approximately 50 years ago. Nevertheless, pipelines in a serviceable condition have been proven to be able to withstand significant levels of ground vibration. This is well documented in several publications, with tests demonstrating that pipelines can withstand ground vibrations in the order of 120 – 250mm/s (ref: Siskind, David E., Stagg, Mark S., Wiegand, John E., Schultz, David L. 1994; "Surface Mine Blasting Near Pressurized Transmission Pipelines." United States Dept of Interior – Office of Surface Mining Reclamation and Reinforcement.)

6. Regulations

Blasting at the proposed pulp mill development site will be governed by the Dangerous Goods (General) Regulations 1998 (S.R. 1998, No.163). The specific activities relating to blasting will be required to be included in a Blasting Management and Safety plan, which is aligned with the requirements of the Dangerous Goods legislation for Tasmania. This includes provision for:

- Permission to undertake blasting activities (required from General Manager of the Municipal area)
- Maintaining ground vibration to within 10mm/s and airblast to within 120dBL
- Assessing all susceptible buildings and structures in accordance with AS 2187 before using explosives in a municipal area
- Monitor ground vibration and airblast if required.

7. Conclusion

Blasting activities associated with the construction of the Longreach Pulp Mill can be safely completed without damaging surrounding structures or services provided that the proposed blasting methods are employed.

The blasting activity of greatest risk is the blasting in close proximity to the power lines. This will require careful supervision, and the use of electronic delay detonators is recommended.

The MIC calculations in this report assume hole-by-hole initiation. Where this is not the case, higher Peak Particle Velocities (PPVs) can be expected.

8. Acknowledgements

The author would like to particularly thank Greg Stanford for his assistance on site and for the provision of materials, plans and photographs.

Photographs provided by Greg Stanford are: 4.1, 4.2, 4.3, 5.1, 5.5.1, 5.6.1, and 5.7.1. The remainder of the photographs in this report were taken by the author.

9. References

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