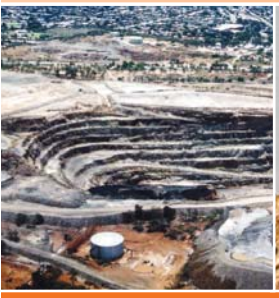
Rasp Mine

Zinc–Lead–Silver Project

Preferred Project Report

Project Application No. 07_0018

September 2010





Broken Hill Operations Pty Ltd

a wholly owned subsidiary of CBH Resources Ltd

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Rasp Mine

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1 INTRODUCTION

Broken Hill Operations Pty Ltd (BHOP) is proposing to expand operations at its Rasp Mine (the Project), which is located in Broken Hill in New South Wales (NSW). The Project would involve:

- extending the areas for underground mining to include the Western Mineralisation, Centenary Mineralisation and additional Main Lode Pillars;
- increasing mining production to 750,000 tonnes per annum (tpa); and
- constructing and operating a processing plant to produce 44,000 tpa of lead and 87,000 tpa of zinc concentrate.

The Project is declared a Major Project by the State Environment Planning Policy (SEPP) (Major Development) 2005, and therefore requires the approval of the NSW Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act*, *1979* (EP&A Act). BHOP lodged a Major Project Application (07_0018) with the Department of Planning (DoP) on 10 March 2007.

An *Environmental Assessment Report* (EAR) (BHOP, July 2010) supporting this application was exhibited from 2nd July to 6th August 2010. Following the exhibition of the EAR, the DoP received 14 public and government agencies submissions on the Project, including 11 submissions in support, 2 submissions objecting and 1 submission that did not state its position.

A formal *Response to Submissions* (RTS) report was prepared in accordance with Section 75H(6) of the EP&A Act and will be submitted to the DoP in September 2010.

Since exhibiting the EAR, BHOP has modified the layout and design of the Project in order to further minimise environmental impacts and streamline operations. The modifications involve:

- modifying the Project Area to include the new rail load-out area at the north-eastern end of the site;
- locating the processing plant to the north-eastern end of the lease (away from densely populated residential areas);
- removal of secondary and tertiary crushers and screens from the crushing circuit; and
- loading concentrate into containers on trucks and transporting them to a newly constructed rail siding located at the north-eastern end of the lease.

The modified project is referred to as the “Preferred Project”. The Director-General has requested that BHOP prepare and submit a Preferred Project Report that outlines the proposed changes to the Project and the subsequent reductions in environmental impacts.

BHOP engaged GWP Environmental Planning Pty Ltd (GWP) to prepare this Preferred Project Report (PPR). It is understood that DoP intends to publically exhibit this report in accordance with Section 75H(7) of the EP&A Act.

1.1 BACKGROUND

The environmental assessments undertaken as part of the EAR are based on the location of the processing plant and associated infrastructure at the south-west end of Consolidated Mining Lease 7 (CML7). BHOP’s original decision to locate the processing plant in this location was based on several key factors, including:

- convenient access to existing services (gas, water, power);

- convenient access to site entrance / exit point;
- convenient access to site offices and administration building;
- proximity to existing rail siding; and
- limited alternative locations due to the extensive waste dumps located around the site.

In addition, at the time of preparing the EAR, BHOP did not have full knowledge about the existing ore resources within CML7 and did not want to compromise the extraction of ore due to an alternate location of the processing plant.

Since exhibiting the EAR, BHOP has undertaken additional investigations to further define the lead-zinc-silver ore resource within CML7. These investigations have indicated that the ore reserves at the north-eastern end of the lease can be economically mined by underground methods and that these mining methods would not compromise processing plant infrastructure located above the ore body.

Consequently, BHOP investigated alternate process plant locations at the north-eastern end of the lease, further away from the densely populated residential areas in the south. The key driver for the relocation of the processing plant is to reduce environmental impacts, primarily associated with air quality (dust) and noise from the processing plant operations.

This PPR clearly demonstrates that significant environmental advantages will be achieved by relocating the processing plant and rail loading facility to the north-eastern end of the lease.

1.2 REPORT STRUCTURE

Chapter 2 of this PPR provides a detailed description of the layout and design of the Preferred Project. With the exception of the modifications described in Chapter 2, the description of the Project as a whole will remain as per Chapter 2 of the EAR.

Chapter 3 of this PPR provides a summary of the revised air quality, noise and vibration, stormwater and visual amenity assessments. Chapter 3 also provides a discussion about the implications of the revised air quality modelling for the health risk assessment.

The assessments of other environmental issues provided in the EAR remain relevant and have not been discussed further in this PPR. These include greenhouse gases, groundwater resources, heritage, ecology, traffic and transport, waste, socio economic, rehabilitation and final landform.

Chapter 4 provides a summary of the consultation that has been undertaken following the exhibition of the EAR in order to inform government agencies and other stakeholders about the Preferred Project.

Chapter 5 provides a list of the advantages of the Preferred Project and provides concluding remarks.

BHOP has revised its Statement of Commitments for the Project to reflect changes in the modified layout and design of the Project and to address the issues raised in the submissions. The revised Statement of Commitments has been included in ***Appendix A***.

2 REVISED PROJECT DESCRIPTION – PREFERRED PROJECT

The following section provides a description of the proposed changes to the layout, design and operation of the Project following exhibition of the EAR. The changes have been made in order to further minimise environmental impacts associated with the original proposal and to provide additional streamlining of operations.

The modifications involve:

- modifying the Project Area to include the new rail load-out area at the north-eastern end of the site;
- locating the processing plant to the north-eastern end of the lease (away from densely populated residential areas) and modifying haulage road routes;
- removal of secondary and tertiary crushers and screens from the crushing circuit; and
- loading concentrate into containers on trucks and transporting them to a newly constructed rail siding located at the north-eastern end of the lease.

With the exception of these modifications, the description of the Project as a whole will remain as per Chapter 2 of the EAR.

2.1 PREFERRED PROJECT AREA

The Preferred Project area is shown on ***Figure 2-1*** (this figure replaces Figure 1-3 of the EAR). The only change from the original Project area is the inclusion of the area of land at the north-eastern end of the lease for the location of the proposed new rail siding.

The additional land covers an area of approximately 3 hectares and is wholly owned by Australian Rail & Track Corporation (ARTC).

2.2 PREFERRED PROCESSING PLANT LOCATION

BHOP proposes to relocate the processing plant from the original site in the southeast corner of the lease to a preferred location at the north-eastern end. The preferred processing plant location and the general arrangements of the site and services are shown on ***Figure 2-2***.

The preferred processing plant location is approximately 225 metres further away from the nearest residences than the original plant location (ie. the original location was 200 metres north of the nearest residences while the proposed location is 425 metres north west of the nearest residences). Similarly, the new processing plant location is situated approximately 220 metres further away from the city centre.

The proposed relocation of the processing plant is preferred as it removes the major noise and dust generating activities from the densely populated areas south and west of the lease.

The preferred plant location is now located to the north of industrial and commercial properties including:

- Blue Metal Quarry (now Mawsons Quarry);
- a large parcel of vacant land forming part of a mining lease owned by Perilya Broken Hill Operations Pty Ltd (Perilya); and
- a wood cutters yard.

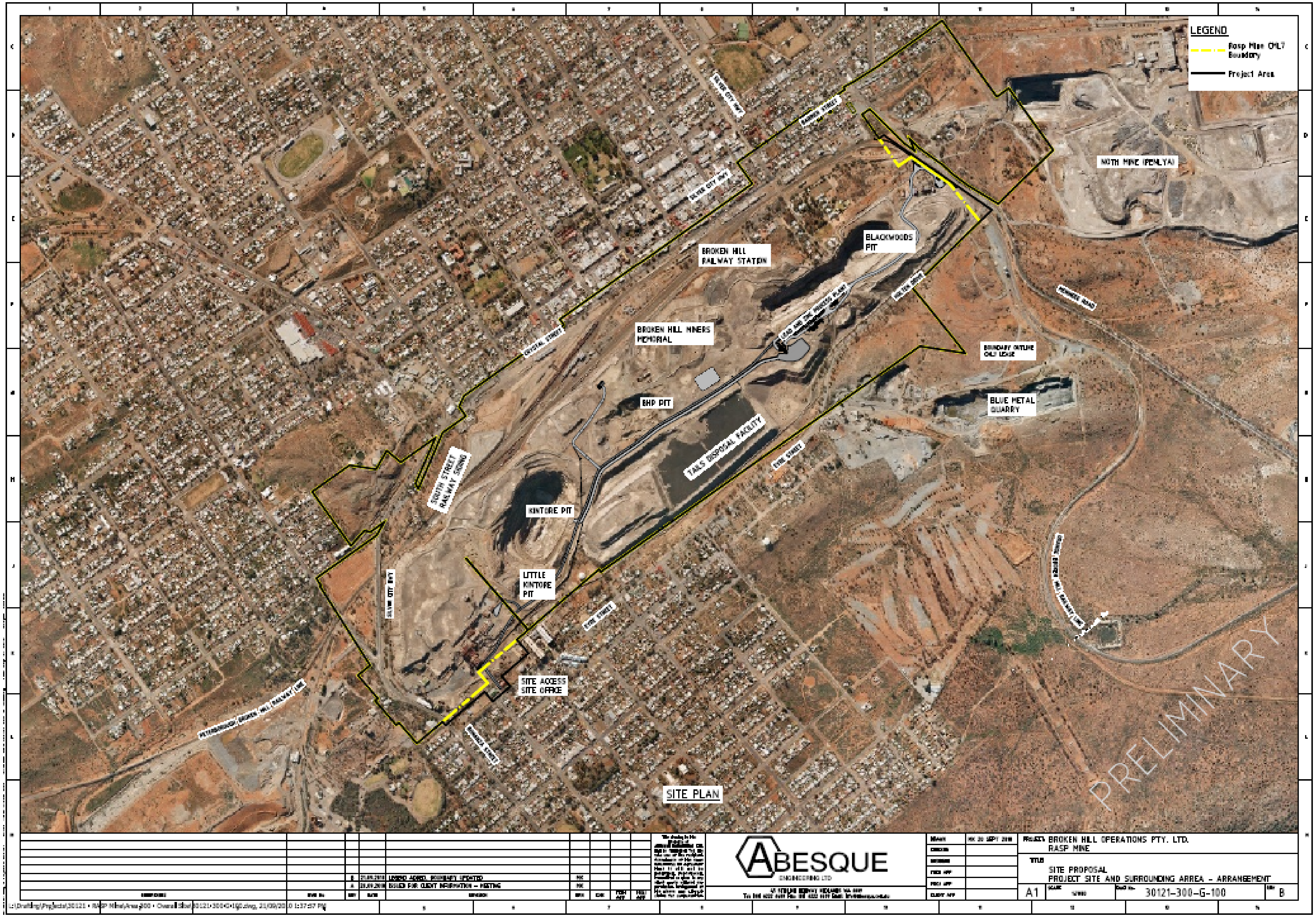

Figure 2-1: Preferred Project Area

Figure 2-2: General Site Layout for Preferred Project

Two residential properties are located approximately 425 metres south-west of the preferred processing site location, along Eyre Street. The Perilya Broken Hill North Mine is located to the east.

There are two vacant buildings to the north of the new processing plant site, which are located on CML7. These properties are unoccupied and are owned by the Line of Lode Association. It is understood that the Line of Line Association is currently negotiating a transfer of these buildings to the Broken Hill City Council (BHCC). These structures are of heritage significance. One is a previous mine manager's house dating to the early part of the 20th Century and the other was constructed in the 1930s as part of offices for the Broken Hill Proprietary Company (BHP).

An area known as "Proprietary Square" is located further to the north. Proprietary Square is a small building development, which is owned and maintained by Perilya and situated on CML 4. It consists of twelve buildings, some of which are used as training meeting facilities and some that are used for residential housing.

The preferred plant location is optimally situated on old waste dumps, above Holten Drive and adjacent to Blackwood Pit. A depression, which currently houses a road, will be deepened to accommodate the processing plant and this, together with noise abatement bunding, will provide shielding of the plant from road users along Holten Drive. Cross-sections illustrating the topography from Holten Drive are provided in ***Figure 2-3***.

The construction of the processing plant in the preferred location would require modifications to the mine ore haulage route to the run-of-mine (ROM) pad and a new concentrate container carting route to the relocated rail siding. The haulage routes are indicated on ***Figure 2-2***. All haulage roads and primary access roads, totalling approximately 4.5 kilometres, will be sealed in order to reduce airborne dust impacts. Noise abatement bunding is also planned around the southern perimeter of the ROM pad and along sections of the haulage/cartage routes.

The proposed relocation also minimises the potential for visual impacts and impacts from site lighting to south Broken Hill residents and persons travelling along Eyre Street and South Road. It also provides a more efficient plant layout with the reagent storage and mixing areas positioned closer together.

2.3 MINERAL PROCESSING

Recent investigations into the optimal design of the processing plant and modelling of the comminution circuit have indicated that a single stage crushing circuit with a two stage SAG - Ball milling circuit will be capable of processing ore at the 750,000 tpa rate. A plant layout plan is provided in ***Figure 2-4***. A flow-chart illustrating the processing stages is provided in ***Figure 2-5***.

2.3.1 Crushing (Section 2.5.2 of EAR)

The Preferred Project will use conventional open circuit single stage crushing for the production of grinding circuit feed at a nominal size of 80% passing 100 mm. The SAG mill can accommodate the larger size feed removing the need to crush to 15 mm through the secondary and tertiary crushers.

Crushing activities will continue to take place on day shift only.

The ROM pad is designed to hold a maximum of three days capacity. Ore from underground will continue to be delivered 24 hours per day, 7 days per week and dumped onto grade control ore fingers. The new ore haulage road will follow the current main access road west to east across the site passing Tailings Storage Facility 1 (TSF 1) to the proposed new ROM pad location to the east of Horwood Dam. The haulage distance between Kintore Pit and the proposed processing plant site is the same as the original route. It will also be sealed.

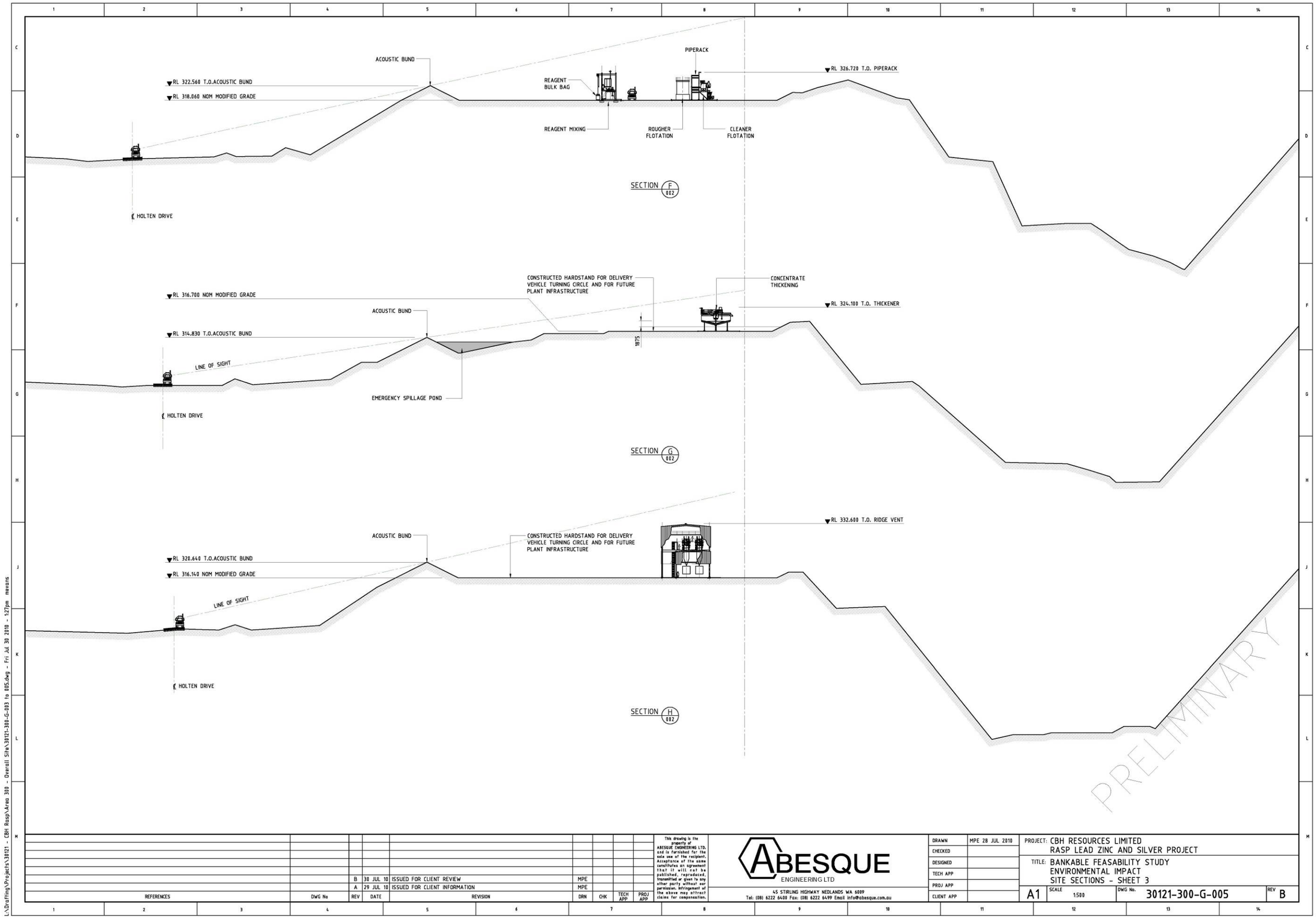

Figure 2-3: Processing Plant Cross Section

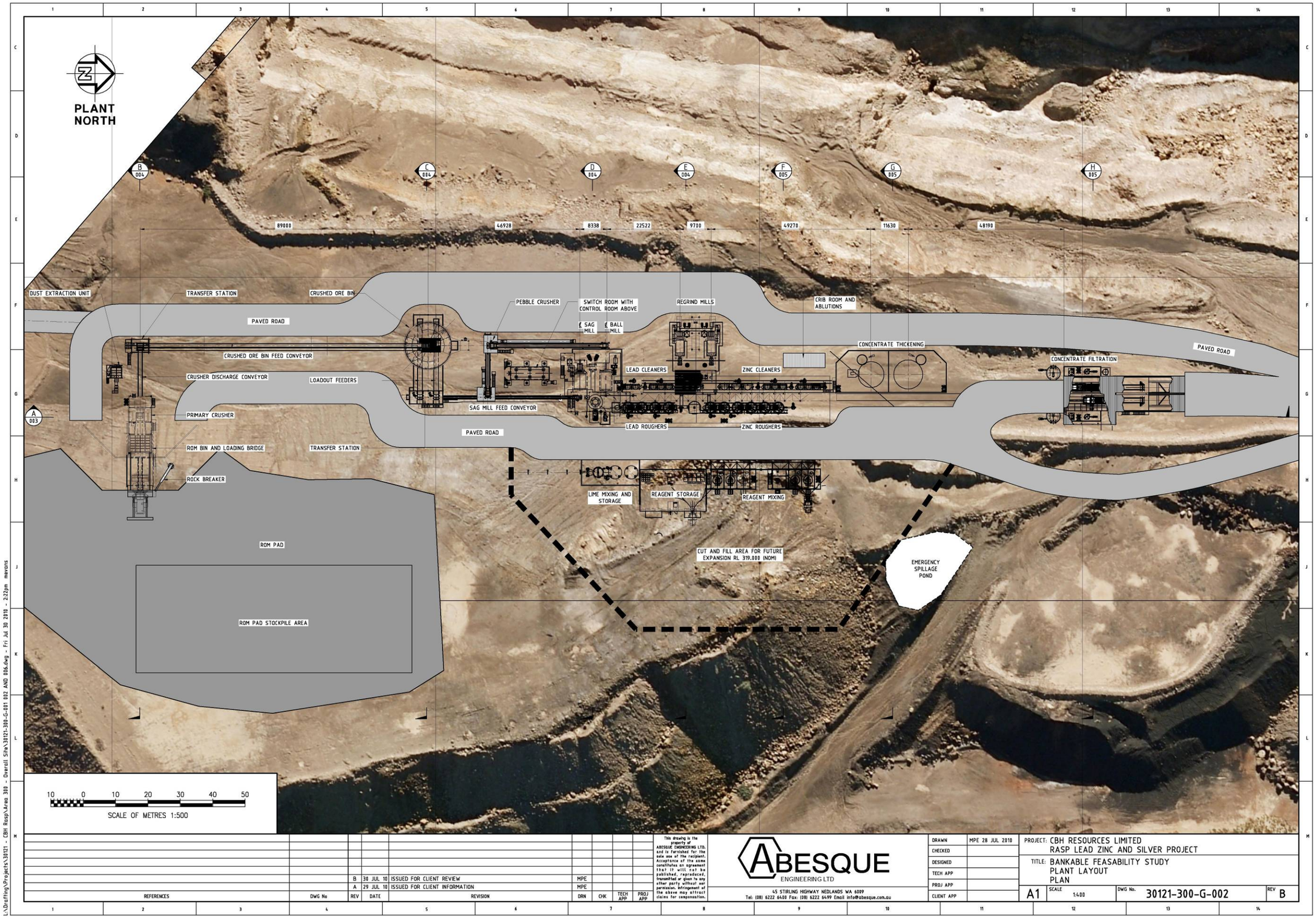

Figure 2-4: Plant Layout

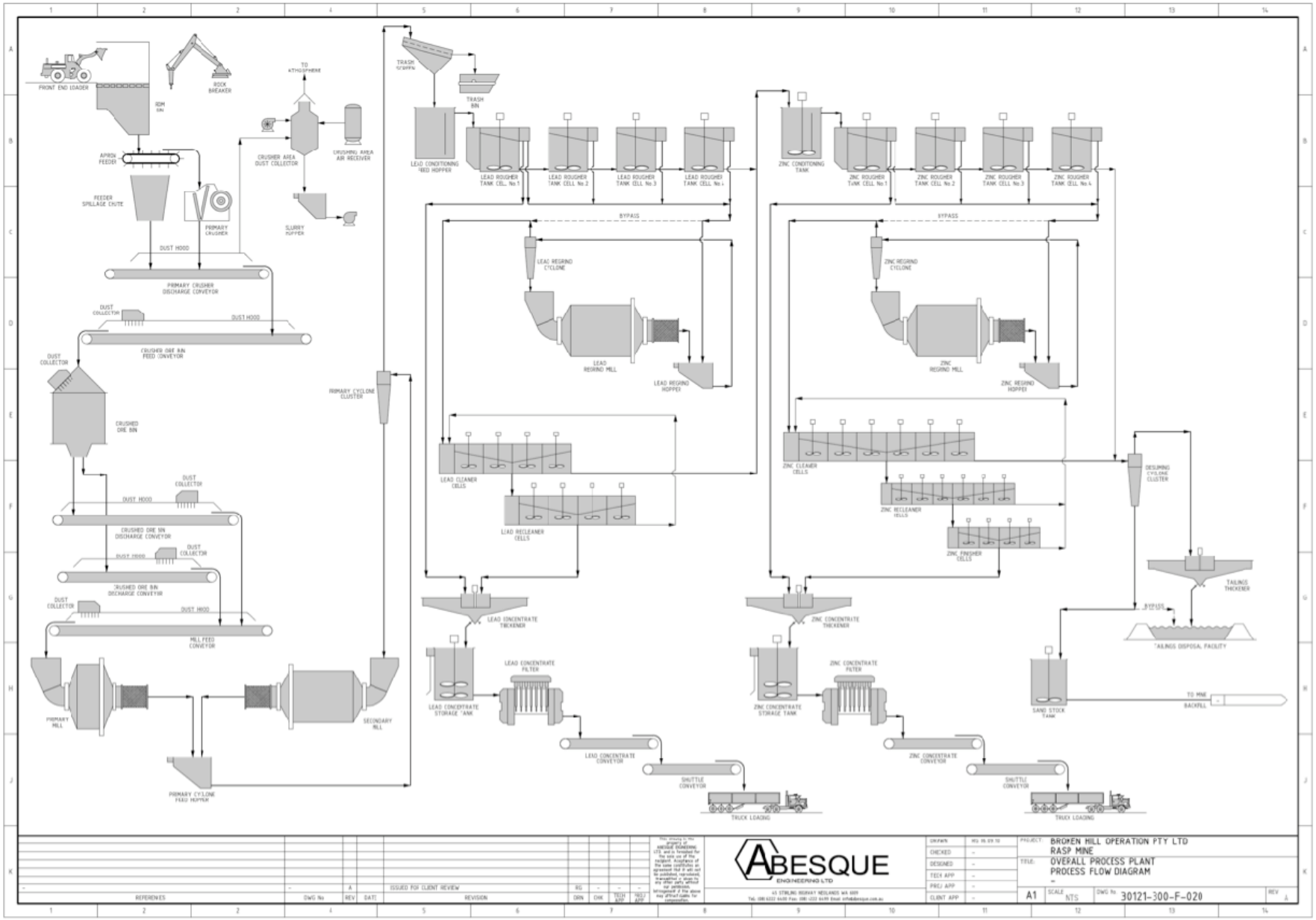

Figure 2-5: Process Flow Chart

Additionally the haul road between Kintore Pit and the alternative site is a straight run, with fewer changes in gradient, resulting in lower maintenance costs and reduced exhaust and noise emissions. It removes the need to establish the new western haul road.

ROM ore, at a nominal top size of 800 mm, will be reclaimed from stockpiles by a front end loader (FEL) and fed into a steel ROM bin situated in a concrete pocket. The live capacity of the ROM bin will remain at 150 t.

As in the previous design, a fixed rock breaker will be installed adjacent to the jaw crusher feed opening.

Ore will discharge from the ROM bin via a hydraulic drive apron feeder and report to the primary jaw crusher. Jaw crusher product will report via a chute to a series of enclosed conveyors, prior to discharge into the enclosed 2,250 tonne crushed ore bin (this is the same size as the previous fine ore bin).

It is highlighted that the proposed crushing circuit no longer requires (potentially dust generating) secondary and tertiary crushers and associated screens as material from the jaw crusher passes directly into the SAG mill, which is a wet process.

To further reduce noise and dust generated from the crusher a number of control measures are proposed. Noise abatement bunds will be installed around the ROM pad and on the north and south side of the primary crusher structure. Particulate emissions will be captured through hooded extraction to a bag house. In addition, all conveyors and transfer points prior to the grinding circuit will be fully enclosed and dust controlled via insertable bag dust collection units. Strategically placed misting sprays will further assist in the control of fugitive dust emissions.

Collected dust will be mixed with raw water and pumped to the grinding circuit as slurry. The crushed ore bin will operate in the same manner as the previous fine ore bin. It will be open bottomed and supported on concrete wings to allow access by mobile equipment in the event of a blockage. Under normal operation crushed material will rill out of the wings and seal the openings to prevent dust emission. An insertable bag dust collector will be installed in the roof of the crushed ore bin to minimise dust emission from the feed entry. Ore will be reclaimed from the crushed ore bin via two slot feeders discharging onto two conveyor systems leading to the SAG mill.

2.3.2 Grinding (Section 2.5.3 of the EAR)

The operation of the grinding and classification circuit remains unchanged, 24 hours per day, 7 days per week. The design throughput rate will be 750,000 tonnes per annum, resulting in a grinding circuit feed rate of 93.8 tonnes per hour, also unchanged.

The grinding circuit will consist of a primary SAG Mill and secondary ball mill. The target primary final grind size will be 80% passing 200 microns, identified by test work as the optimum size for lead and zinc flotation.

Crushed ore will be fed via a mill feed conveyor into the primary SAG mill feed chute replacing the primary mill. SAG mill discharge will flow via a trommel screen into the primary hydrocyclone feed hopper before being pumped via variable speed pump to the primary hydrocyclone cluster. Grinding water will be added to the feed chute of the SAG mill and the primary hydrocyclone feed hopper in order to control grinding and classification pulp density. The process continues through the secondary mill as per the previous design.

Grinding circuit spillage will be contained by a bunded concrete slab and recovered to the process via a single vertical spindle sump pump. Sufficient fall will be provided on grinding circuit floors to allow for the coarse nature of grinding circuit products and the high specific gravity minerals.

2.3.3 Floatation (Section 2.5.4 of the EAR)

The flotation process is unchanged however in order to reduce noise generation, the flotation process will be housed within a building.

Flotation circuit spillage will be contained by bunded concrete slabs separated into lead and zinc areas by a dividing wall and recovered to the process via vertical spindle sump pumps. Sufficient fall will be provided on flotation circuit floors to allow for the high specific gravity minerals.

2.3.4 Concentrate Handling (Thickening, Filtration, Storage and Load-out) (Section 2.5.5 of EAR)

The concentrate handling circuit remains unchanged operating in conjunction with the flotation circuit, 365 days per year, 24 hours per day. It will continue to be housed in a clad building. However the loading of concentrate for off-site transport has changed due to the new location of the rail siding to the north-eastern end of the site.

It is proposed to load concentrate into a container loaded onto a truck and transport to the rail siding. Empty concentrate containers will be loaded onto a 45 t truck with attached drop deck trailer and then driven to a weigh bridge where they will be weighed. The truck will then be driven into the enclosed filter building, and positioned under the shuttle conveyor where the lid will be removed.

The filter then discharges filter cake into a collecting hopper, which is fitted with a load cell. A conveyor is fitted at the base of the hopper, which transfers concentrate to the container filling shuttle conveyor.

The container filling shuttle conveyor is designed to move forward in set increment over the 6.1 meter length of the container to enable the filter cake to be distributed evenly along the length of the container. The time required to fill the container is estimated to be 5 minutes.

The container lid will then be replaced and the truck and concentrate container will drive through a washing facility where both the truck and container will be washed to remove any spilled material. The wash water and solids will be collected and recycled back to the concentrate thickener. The truck will then be driven to the rail load out area and the container unloaded with a forklift, either onto the rail wagon or storage area.

The lead and zinc daily concentrate production requires 8 containers for lead production and 12 containers for zinc production resulting in 20 truck cycles (from the rail load out area to the filter building and return) per day. The road from the concentrate load out to the rail siding is approximately 910 m and will be sealed. Truck movements will occur 24 hours per day 7 days per week and noise abatement bunding will be installed to the north-west of the road to minimise impacts.

2.2.5 Loading & Transport of Concentrate (Section 2.5.6 of EAR)

The layout of the new load-out area, including the footprint for the new rail siding is shown in ***Figure 2-6***.

Despatch of the loaded wagons to the Broken Hill rail complex is unchanged and is planned to occur daily (7 am to 6 pm), requiring 10 wagons loaded with concentrate containers leaving site.

The load-out area will require the construction of a new rail siding off the main Sydney – Perth railway line. ***Figure 2-6*** shows a preliminary rail siding design suggested by the Australian Rail Track Corporation (ARTC). BHOP has engaged a rail design engineer to work with ARTC on an agreed layout.

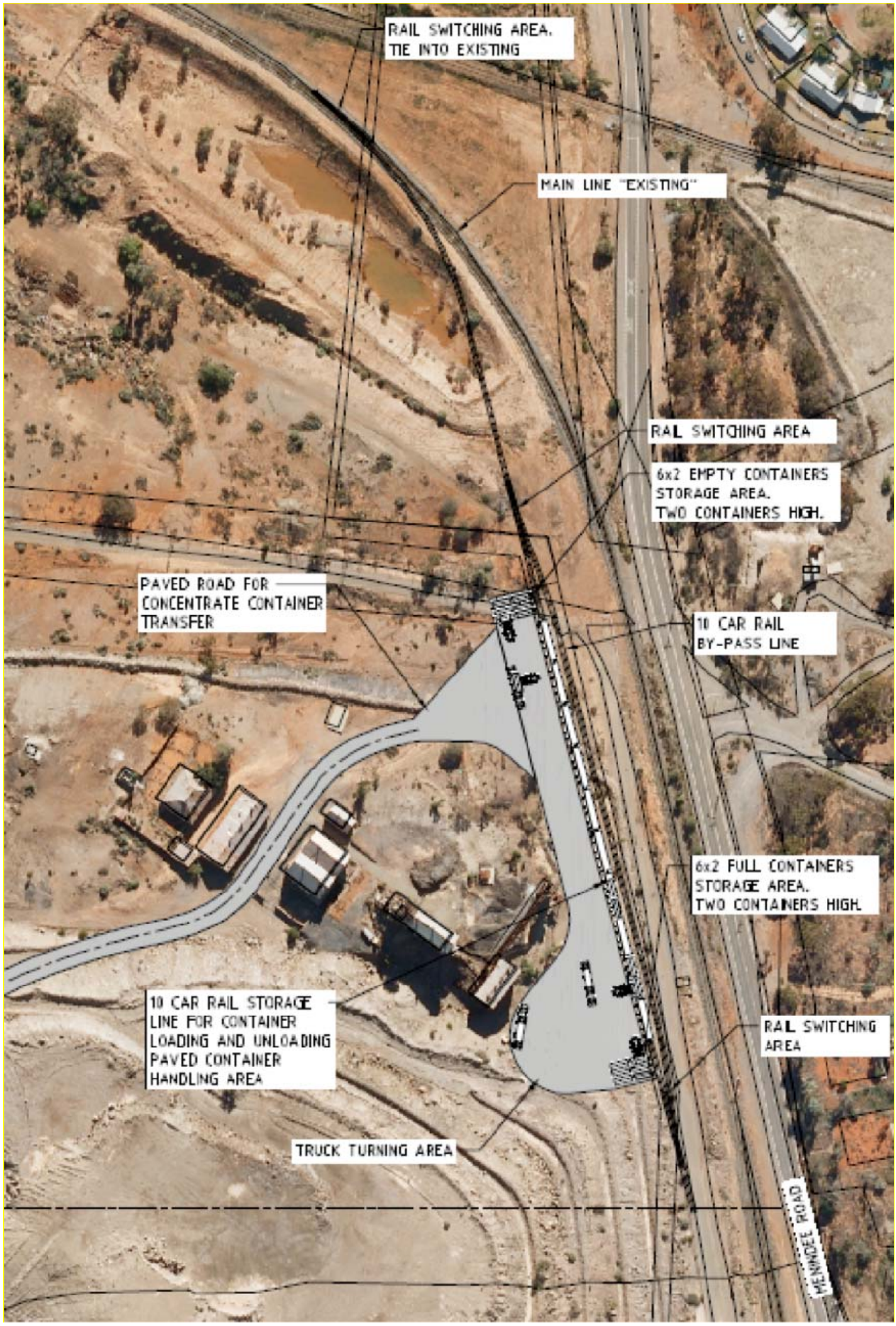

Figure 2-6: Rail Load-out Area

The new rail load out configuration provides additional benefits to the original spur line. The previous spur line was only suitable for local shunting engines and could not be negotiated by main line engines. Due to the tight radius of the line there was also significant risk of excessive noise while shunting wagons on to and off the lease. The new railway siding will not have constraints on the size of locomotive and will not have the noise issues inherent in the spur line at the southern end of the lease.

The closest buildings to the new rail siding are at Browns Shaft located to the east of the rail siding on CML7. This area comes under a tourist lease administered by the BHCC and includes a number of heritage buildings and structures and two residential properties occupied by BHOP personnel.

3 REVISED ENVIRONMENTAL ASSESSMENTS

This chapter provides a summary of the revised air quality, noise and vibration, stormwater and visual amenity assessments undertaken for the Preferred Project. This chapter also includes a discussion about the implications of the revised air quality modelling for the health risk assessment associated with the Preferred Project.

As previously indicated, the assessments of other environmental issues provided in the EAR remain relevant and have not been discussed further in this PPR. These include greenhouse gases, groundwater resources, heritage, ecology, traffic and transport, waste, socio economic, rehabilitation and final landform.

3.1 AIR QUALITY ASSESSMENT

BHOP commissioned ENVIRON Australia Pty Ltd (ENVIRON) to evaluate the air quality impacts associated with the new location of the processing plant, The results are provided in the *Air Quality Assessment Addendum 2010* (Addendum) provided at ***Appendix B***.

The Addendum focussed on emissions of total suspended particulates (TSP), particulate matter less than 10 microns and 2.5 microns in aerodynamic diameter (PM_{10} and $PM_{2.5}$ respectively), dust deposition and a range of individual metals/metalloids for the Preferred Project.

Due to the reduced dust generation potential from the revised crushing circuit, the Addendum includes an evaluation of the potential for reconfiguration of the crushing circuit dust controls. In addition, the Addendum provides supporting information in relation to the following requests from the Department of Environment, Climate Change and Water (DECCW):

- inclusion of contour plots for at least one metal scenario modeled at a 1-hour averaging period; and
- additional modeling assessment of 'upset conditions' at the TSF.

Finally, the Addendum makes comment as to the implications of revised modelling for health risk assessment of the Preferred Project.

3.1.1 Dispersion Modelling

Dispersion simulations were undertaken for the Preferred Project and results analysed for TSP, PM_{10}, $PM_{2.5}$ and a range of heavy metal concentrations and dust deposition. Dispersion modelling of particulate emissions was conducted utilising the US-EPA regulatory model AERMOD for two complete calendar years, namely 2008 and 2009.

Sources of atmospheric emissions associated with maximum production activities during the operation phase were identified and are listed in Section 4 of the Addendum. Fugitive dust sources associated with the operation phase of the Project were quantified consistent with the approach within the air assessment, principally through the application of Australian National Pollutant Inventory (NPI) emission estimation techniques and United States Environmental Protection Agency (US-EPA) AP-42 predictive emission factor equations.

3.1.2 Crushing Circuit Alternative Dust Control Emissions

The *Air Quality Assessment* (ENVIRON, 2010) undertaken as part of the EAR (Appendix H) evaluated a crushing circuit (primary, secondary and tertiary crushers and associated screens) with all potential particulate emissions contained via full enclosure under negative pressure, with emissions diverted to a baghouse (99.5% control efficiency).

As discussed previously, the relocation of the processing plant has allowed for a reduction in the potential dust generating sources, through removal of the secondary and tertiary crushers and associated screens. The revised crushing circuit requires a primary crusher only, with material transferred directly to the SAG mill, which is a wet process.

Due to the reduced dust generation potential from the revised crushing circuit, combined with technical and operational constraints identified associated with the previous dust control configuration, alternative dust controls were evaluated. These controls included cladding to the primary crusher with emissions captured through hooded extraction to a baghouse.

The evaluation indicates that the selection of crusher configuration (ie. full enclosure under negative pressure with all emissions vented to a baghouse versus acoustic cladding with hooded extraction) is not a critical factor in predicted concentrations from the Preferred Project. Enclosing the crusher area with noise cladding and capturing particulate emissions through targeted hooded extraction to a bag house provides effective dust control while reducing the air volumes required to be treated. This crusher configuration, which is referred to as Scenario 2 in ***Appendix B***, has therefore been adopted.

3.1.3 Modelling Results

A summary of the results of the air quality modelling results for the Preferred Project compared to the original Project are provided in ***Table 3-1***. The Preferred Project results incorporate the relocated processing area, normal TSF operations, enclosed crusher area with noise cladding, and emissions captured through hooded extraction (ie. Scenario 2).

Table 3-1: Summary of Air Quality Modelling Results for the Preferred and Original Project

Receptors	PM10 24 hour (µg/m³)		PM10 Annual Average (µg/m³)		Annual Average Dust Deposition (g/m²/year)		Annual Average Lead Deposition (g/m²/year)	
	Original	Scenario 2	Original	Scenario 2	Original	Scenario 2	Original	Scenario 2
R1	2.3	**2.5**	0.4	**0.4**	0.21	**0.19**	0.05	**0.04**
R2	3.6	**3.1**	0.5	**0.5**	0.29	**0.18**	0.11	**0.05**
R3	5.9	**5.1**	0.9	**0.8**	0.55	**0.32**	0.22	**0.09**
R4	4.2	**3.1**	0.8	**0.5**	0.30	**0.25**	0.12	**0.06**
R5	4.3	**3.1**	0.6	**0.4**	0.22	**0.16**	0.09	**0.04**
R6	6.5	**4.7**	0.8	**0.6**	0.25	**0.17**	0.10	**0.04**
R7	3.1	**1.2**	0.4	**0.2**	0.16	**0.04**	0.07	**0.01**
R8	10.5	**2.3**	1.7	**0.4**	0.94	**0.12**	0.45	**0.03**
R9	3.4	**1.6**	0.7	**0.3**	0.37	**0.09**	0.15	**0.02**
R10	1.8	**1.4**	0.4	**0.2**	0.18	**0.09**	0.06	**0.02**
R11	2.8	**2.2**	0.4	**0.3**	0.14	**0.08**	0.06	**0.02**

R12	1.7	**1.9**	0.2	**0.2**	0.09	**0.06**	0.04	**0.02**
R13	1.5	**1.8**	0.2	**0.2**	0.07	**0.05**	0.03	**0.01**
R14	1.5	**1**	0.2	**0.2**	0.10	**0.05**	0.04	**0.01**
R15	0.9	**0.6**	0.1	**0.1**	0.02	**0.02**	0.01	**0.01**
R16	0.7	**0.8**	0.1	**0.1**	0.02	**0.03**	0.01	**0.01**
R17	1.2	**0.9**	0.2	**0.1**	0.06	**0.05**	0.02	**0.01**
R18	1.3	**1**	0.2	**0.1**	0.05	**0.02**	0.02	**0.01**
R19	0.5	**0.6**	0.1	**0.1**	0.01	**0.02**	0.00	**0.01**
R20	0.7	**0.6**	0.1	**0.1**	0.02	**0.02**	0.01	**0.01**
R21	3.0	**3.5**	0.4	**0.6**	0.28	**0.28**	0.04	**0.05**
R22	3.6	**4.1**	0.5	**0.6**	0.30	**0.32**	0.04	**0.06**
R23	2.6	**4**	0.4	**0.6**	0.22	**0.31**	0.03	**0.08**
R24	2.4	**5**	0.4	**0.7**	0.14	**0.37**	0.03	**0.11**
R25	1.9	**2.3**	0.3	**0.4**	0.14	**0.17**	0.03	**0.04**
R26	2.6	**6.3**	0.4	**0.8**	0.11	**0.43**	0.02	**0.15**
R27	2.0	**7.4**	0.2	**1.0**	0.09	**0.47**	0.02	**0.20**
R28	2.2	**4.7**	0.2	**0.8**	0.08	**0.37**	0.02	**0.15**
R29	1.8	**3.8**	0.3	**0.7**	0.08	**0.34**	0.02	**0.14**
R30	1.5	**3**	0.2	**0.6**	0.07	**0.26**	0.02	**0.10**
R31	1.4	**2.3**	0.2	**0.4**	0.06	**0.16**	0.02	**0.06**
R32	1.4	**1.8**	0.2	**0.3**	0.05	**0.15**	0.01	**0.05**
R33	1.6	**3**	0.2	**0.3**	0.04	**0.15**	0.01	**0.05**
R34	2.2	**1.8**	0.4	**0.4**	0.17	**0.15**	0.05	**0.04**
R35	2.0	**2.2**	0.4	**0.4**	0.13	**0.16**	0.04	**0.04**
R36	1.5	**1.7**	0.3	**0.4**	0.11	**0.16**	0.03	**0.04**
R37	1.4	**1.9**	0.3	**0.4**	0.09	**0.16**	0.02	**0.05**
R38	2.3	**1.4**	0.3	**0.1**	0.10	**0.03**	0.04	**0.01**
R39	2.5	**1.3**	0.3	**0.2**	0.12	**0.04**	0.05	**0.01**
R40	2.6	**2**	0.6	**0.3**	0.30	**0.11**	0.11	**0.03**
R41	2.7	**2.1**	0.5	**0.3**	0.28	**0.13**	0.09	**0.03**
R42	2.7	**2.1**	0.5	**0.4**	0.24	**0.15**	0.07	**0.04**

Note S2 represents Scenario 2 - Relocated processing area with normal TSF operations and crusher area enclosed with noise cladding and emissions captured through hooded extraction.

Table 3-1 indicates that the maximum change in incremental predictions of key air quality indicators across all sensitive receptors between the original Project and the Preferred Project are:

- **24-hour PM_{10}:** 0.6µg/m^3 (Receptor R24; a change from 4.4 µg/m^3 to 5.0 µg/m^3);
- **Annual PM_{10}:** 0.1µg/m^3 (Receptors R6 (now 0.6 µg/m^3), R11 (now 0.3 µg/m^3), R26 (now 0.8 µg/m^3), R27 (now 1.0 µg/m^3), R31 (now 0.4 µg/m^3), R39 (now 0.2 µg/m^3));
- **Annual Average Dust Deposition:** 0.07g/m^2/month (Receptor R27; a change from 0.40µg/m^3 to 0.47µg/m^3); and
- **Annual Average Lead Deposition:** 0.41g/m^2/year (Receptor R27 a change from 0.135g/m^2/year to 0.175g/m^2/year)).

Overall, incremental impacts are predicted to reduce at receptor locations representative of groups of receptors and incremental impacts are predicted to increase at locations representative of single dwellings.

Additionally, locations with the highest predicted increases occur at industrial premises (receptor R26) or unoccupied heritage buildings on the CML7 mining lease (receptors R27 and R28).

24-Hour PM_{10}

Under normal operations, the Project-incremental concentration of PM_{10} is predicted to contribute up to 15% of the DECCW criterion of 50µg/m³ for the worst case 24-hour period across all receptors and the two years of modelling.

Previous modelling predicted incremental contributions of up to 20% of the DECCW criterion.

Average Annual PM_{10}

Annual average PM_{10} concentrations are predicted to be below the DECCW air quality criterion of 30µg/m³. Taking background particulate concentrations into account, the maximum (cumulative) concentration predicted over the two years of modelling is anticipated to be between 92% and 95% of the DECCW criterion across all sensitive receptors.

It is noted that the maximum predicted Preferred Project-related increment in annual PM_{10} concentrations across all receptors and modelled years is 1.0µg/m³, or 3% of the DECCW criterion.

Previous modelling predicted Project-related increment was 1.7µg/m³ contributing up to 6% of the DECCW criterion.

Total Suspended Particulate

Annual average concentrations of TSP from Project-related sources are predicted to be significantly below the DECCW air quality criterion of 90µg/m³ ranging from 0.2µg/m³ to 2.4µg/m³. Taking background particulate concentrations into account (64.9µg/m³), the maximum (cumulative) concentration predicted over the two years of modelling is anticipated to be 76% of the DECCW criterion of 90µg/m³ across all sensitive receptors.

Dust Deposition

A maximum incremental annual average dust deposition rate of 0.47g/m²/month (receptor R27 located on the CML7 mining lease) was predicted to occur across the receptor locations due to maximum production activities. This rate is within the NSW DECCW incremental dust deposition limit of 2 g/m²/month.

Previous modelling predicted incremental annual average dust deposition rates of up to 0.94 g/m²/month.

Heavy Metal Concentrations

A synopsis of maximum Preferred Project-related incremental 99.9th percentile hourly and annual average heavy metal concentrations predicted to maximum production activities across all discrete receptor locations is provided in ***Appendix B*** (Section 5.8), with reference made to relevant DECCW impact assessment criteria. Such criteria are reported at the predicted 99.9th percentile (or 9th highest 1-hourly average) concentration, consistent with Section 7.2.2 of the DECCW Approved Methods.

No exceedances of the relevant DECCW impact assessment criteria for the above toxic air pollutants were predicted to occur under maximum production conditions.

Lead

DECCW specify an annual air quality criterion for lead that is specific for cumulative concentrations. Performance against this criterion is evaluated in ***Table 3-2.***

Table 3-2: Predicted Annual Average Lead (Pb) Concentrations due to Maximum Production Activities at Representative Sensitive Receptors – Maximum for Model Years 2008 and 2009

Receptors		Pb Concentrations (µg/m³)			Cumulative Pb as % of DECCW Criterion	Original Assessment Cumulative Pb as % of DECCW Criterion
		"Future Baseline" (Existing Free Areas, 80% Control Efficiency)	Preferred Project-Related Increment	Cumulative Pb (Baseline + Project Increment)		
R1	Piper Street North	0.041	0.010	0.051	10%	11%
R2	Piper Street Central	0.026	0.012	0.038	8%	10%
R3	Eyre Street North	0.028	0.026	0.054	11%	15%
R4	Eyre Street Central	0.018	0.020	0.038	8%	11%
R5	Eyre Street South	0.014	0.018	0.032	6%	9%
R6	South Road	0.023	0.014	0.037	7%	13%
R7	Carbon Lane	0.017	0.004	0.021	4%	8%
R8	Old South Road	0.119	0.009	0.128	26%	46%
R9	South Rd	0.046	0.008	0.054	11%	17%
R10	Cnr Garnet & Blende Streets	0.028	0.006	0.034	7%	9%
R11	Alma Bugldi Pre-school	0.010	0.007	0.017	3%	6%
R12	Playtime Pre-school	0.008	0.005	0.013	3%	4%
R13	Alma Primary School	0.007	0.005	0.012	2%	3%
R14	Broken Hill High School	0.015	0.004	0.019	4%	5%
R15	Broken Hill Hospital	0.006	0.002	0.008	2%	2%

R16	N. Broken Hill Primary School	0.006	0.002	0.008	2%	2%
R17	Broken Hill Public School	0.012	0.004	0.016	3%	4%
R18	Rainbow Pre-school	0.004	0.003	0.007	1%	2%
R19	Willyama High School	0.004	0.002	0.006	1%	1%
R20	Morgan Street Primary School	0.005	0.002	0.007	1%	2%
R21	Eyre Street North	0.050	0.013	0.063	13%	13%
R22	Eyre Street North	0.042	0.014	0.056	11%	11%
R23	Eyre Street North	0.031	0.017	0.048	10%	9%
R24	Eyre Street North	0.030	0.024	0.054	11%	9%
R25	Water tank, Lawton Street #	0.025	0.009	0.034	7%	7%
R26	Quarry offices	0.031	0.033	0.064	13%	10%
R27	Proprietary Square	0.056	0.036	0.092	18%	14%
R28	Proprietary Square	0.042	0.026	0.068	14%	11%
R29	Iodide Street	0.047	0.022	0.069	14%	12%
R30	Iodide Street	0.033	0.017	0.050	10%	9%
R31	Crystal Street	0.026	0.010	0.036	7%	7%
R32	Crystal Street	0.021	0.009	0.030	6%	6%
R33	Brownes Shaft Dwelling	0.027	0.010	0.037	7%	7%
R34	Crystal Street	0.044	0.009	0.053	11%	13%
R35	Crystal Street	0.037	0.009	0.046	9%	11%
R36	Crystal Street	0.030	0.010	0.040	8%	9%
R37	Crystal Street	0.027	0.010	0.037	7%	8%
R38	Gypsum Street	0.010	0.004	0.014	3%	5%
R39	Gypsum Street	0.017	0.004	0.021	4%	7%
R40	Silver City Hwy	0.044	0.008	0.052	10%	15%
R41	Silver City Hwy	0.045	0.008	0.053	11%	15%
R42	Silver City Hwy	0.048	0.009	0.057	11%	14%

Baseline lead concentrations have been estimated based on modelled contributions from lead-bearing existing "free" areas (areas susceptible to wind erosion) across CML7 (refer to the *Air Quality Assessment Report*, ENVIRON 2010, for further detail). Given BHOP's commitment to stabilise existing free areas using chemical dust suppressants the "future baseline" lead concentration (assuming 80% control efficiency for existing free areas) is shown as a reflection of background lead concentrations during the operation phase.

In all cases, the DECCW cumulative (baseline plus Project increment) lead criterion of 0.5µg/m³ is predicted to be satisfied at all receptors, with maximum cumulative impacts predicted to comprise 26% of the DECCW criterion. Receptor R8 is predicted to have the highest levels under the original and preferred plant locations due to the contribution lead-bearing existing 'free" areas described above. However with the new plant location the lead concentration has almost halved from a cumulative increment of 0.228µg/m³ to 0.128µg/m³.

Previous modelling of the original Project predicted cumulative lead concentration impacts of up to 46% of the DECCW criterion at R8. The Preferred Project modelling predicts impacts of up to 26% of the criterion.

DECCW do not specify performance criteria in relation to lead deposition. However, predicted rates of lead deposition have implications for the *Human Health Risk Assessment* (HHRA) (Toxikos, 2010) which was undertaken as part of the EAR [Chapter 9 and Annexure I(A & B)]. It is therefore instructive to present predictions of lead deposition rates for both the original Project and the Preferred Project. In this way, the impact of the preferred plant location can be evaluated relative to the original inputs to the HHRA.

A summary of annual average lead deposition rates predicted under the original Project modelling and associated with the Preferred Project are provided in ***Table 3-3.***

Table 3-3: Predicted Annual Average Incremental Lead (Pb) Deposition due to Maximum Production Activities (Original and Scenario 2) at Representative Sensitive Receptors

Receptors		Pb Deposition Rate (g/m^2/year)		Preferred Project Assessment as % of Original Maximum Prediction across all Receptors
		Original Assessment	Preferred Project Assessment	
R1	Piper Street North	0.05	0.04	-90%
R2	Piper Street Central	0.11	0.05	-89%
R3	Eyre Street North	0.22	0.09	-80%
R4	Eyre Street Central	0.12	0.06	-86%
R5	Eyre Street South	0.09	0.04	-91%
R6	South Road	0.10	0.04	-91%
R7	Carbon Lane	0.07	0.01	-97%
R8	Old South Road	0.45	0.03	-93%
R9	South Rd	0.15	0.02	-95%
R10	Cnr Garnet & Blende Streets	0.06	0.02	-95%
R11	Alma Bugldi Pre-school	0.06	0.02	-95%

R12	Playtime Pre-school	0.04	0.02	-96%
R13	Alma Primary School	0.03	0.01	-97%
R14	Broken Hill High School	0.04	0.01	-97%
R15	Broken Hill Hospital	0.01	0.01	-98%
R16	N. Broken Hill Primary School	0.01	0.01	-98%
R17	Broken Hill Public School	0.02	0.01	-97%
R18	Rainbow Pre-school	0.02	0.01	-98%
R19	Willyama High School	0.00	0.01	-98%
R20	Morgan Street Primary School	0.01	0.01	-99%
R21	Eyre Street North	0.04	0.05	-88%
R22	Eyre Street North	0.04	0.06	-87%
R23	Eyre Street North	0.03	0.08	-83%
R24	Eyre Street North	0.03	0.11	-75%
R25	Water tank, Lawton Street #	0.03	0.04	-91%
R26	Quarry offices	0.02	0.15	-66%
R27	Proprietary Square	0.02	0.20	-56%
R28	Proprietary Square	0.02	0.15	-67%
R29	Iodide Street	0.02	0.14	-69%
R30	Iodide Street	0.02	0.10	-77%
R31	Crystal Street	0.02	0.06	-87%
R32	Crystal Street	0.01	0.05	-88%
R33	Brownes Shaft Dwelling	0.01	0.05	-90%
R34	Crystal Street	0.05	0.04	-91%
R35	Crystal Street	0.04	0.04	-91%
R36	Crystal Street	0.03	0.04	-90%
R37	Crystal Street	0.02	0.05	-89%
R38	Gypsum Street	0.04	0.01	-98%
R39	Gypsum Street	0.05	0.01	-98%
R40	Silver City Hwy	0.11	0.03	-94%
R41	Silver City Hwy	0.09	0.03	-92%
R42	Silver City Hwy	0.07	0.04	-91%

In all cases, lead deposition rates are predicted to be less than the maximum deposition rate across all receptors under the original modelling. The highest rate of lead deposition (0.20g/m^2/year at Receptor R27) is predicted to be less than 55% of the maximum deposition rate under the original modelling (0.45g/m^2/year at Receptor R8).

3.1.4 Modelling of TSF 'Upset' Conditions

In response to a request from DECCW, additional modelling has been undertaken of the dust emissions from the TSF under "upset" conditions. The 'upset' scenario requested to be evaluated is as follows:

> *DECCW requests: additional modelling assessment of 'upset conditions' whereby the active cell is assumed to be saturated, with zero emissions, but 100% of the total area of the inactive cell is assumed to be emitting with 90% control efficiency (base the polymer controlling emissions at near capacity effectiveness). This would represent ~10% of total uncontrolled emissions from the inactive TSF cell (100 × 0.1 = 10%).*

The modelling results associated with this scenario are provided in ***Appendix B***. Upset conditions at the TSF have only been predicted for the 24-hour averaging period, as this time period is considered to be a highly conservative time period for upset conditions to occur without any of the mine's contingencies for TSF dust control being implemented.

Modeling indicates that only those receptors in close proximity to the TSF, specifically along the southeast boundary, show a noticeable influence due to the variation between normal and upset operations of the TSF. In all instances, and under the highly conservative assumption that any 'Upset' persists for up to 24-hours, DECCW air quality criteria are anticipated to be satisfied, even at receptors closest to the proposed TSF.

3.1.5 Implications of Revised Modelling for Health Risk Assessment

The outcomes of the HHRA (Toxikos, 2010) conducted as part of the EAR were informed directly by the atmospheric dispersion modelling predictions made within the *Air Quality Assessment Report* (ENVIRON, 2010).

Calculating the intake of a substance from all exposure pathways and comparing the resulting intake to the Tolerable Daily Intake (TDI) is a standard risk characterisation procedure commonly performed in human health risk assessments.

Of the exposure pathways evaluated within the HHRA, ingestion contributed 95 – 98% of the total intake; the majority (again 95 – 98%) of the ingested intake was the result of background intake assumptions for lead. The total daily intake by a child was only approximately 35 – 60% of the TDI for lead, the range being due to the risk zone in which the receptor was located.

Compared to the TDI incremental lead intake due to the cumulative exposure from the mine lease area (i.e. exposure to dust from free areas 80% controlled plus mine activities) was negligible for most receptors. Even for the most impacted receptor identified within the *Air Quality Assessment Report* (Receptor 8) the intake was less than 5% of the TDI and much of this intake was associated with dust from the free areas (80% controlled).

Since at the most affected receptors (Receptors R8 and R3) the total lead intake, including very conservative estimates of background intake from existing soil and diet, was about 60% of the TDI the HHRA concluded that lead exposure resulting from the proposed mine presents little risk to the health of nearby residents.

As indicated in ***Appendix B*** and summarised in Section 3.1.3, predicted lead concentrations and deposition rates at the most affected receptor under revised modelling are lower than those predicted at the most affected receptor within the air assessment.

Maximum predicted lead concentrations and deposition rates at the most affected receptor are summarised as follows:

- Maximum incremental lead concentrations of 0.064µg/m^3 at R8 under previous modelling compared to 0.036µg/m^3 at R27 for Preferred Project modelling (representing a reduction of over 40%); and
- Lead deposition rates of 0.45g/m^2/annum at R8 under previous modelling compared to 0.20g/m^2/annum at R27 for Preferred Project modelling (representing a reduction of over 56%).

Further, the previously most affected receptor in terms of Project-related increment (Receptor 8) was evaluated based on it being assigned the highest lead Risk Zone (Boreland et al. (2009)) in terms of background concentrations of lead in soil. Under the present modelling, the majority of receptors experiencing increases in Project-related lead deposition will be located in areas considered to be in zones of lesser background lead in soil compared to the original modelling.

The relocation of the processing area is predicted to deliver a decrease in lead deposition increments both within areas of higher population density and the higher soil lead Risk Zones (e.g. Risk Zones 1-2) relative to the air assessment scenario.

It is acknowledged that mining lease areas were not included in the original Risk Zones. It is reasonable to assume that Receptors R27 and R28 (on the CML7 mining lease) and Receptors R29 and R30 (on the Perilya mine lease) would be located on areas representative of soils with higher lead levels. For conservatism, these receptors may be awarded the same Risk Zone status as the most affected receptor within the HHRA (Receptor R8; Risk Zone 1). All other inputs used within the HHRA at these locations (Project-related increments of both airborne and deposited lead) are predicted to be less than the most affected receptor values used to reach the conclusions made within the HHRA.

In view of the above, it is considered that the following conclusions made within the HHRA remain valid:

- Lead is the metal of most concern regarding potential health effects of dust emissions from the Rasp Mine site.
- Conservatively high exposure assumptions, inclusive of identifiable background exposures, for the most impacted receptor resulted in lead intake by a child that was 60% of the TDI.
- Lead in dust emissions from the Preferred Project are therefore unlikely to result in health effects for the surrounding community.
- Predicted increments in child blood lead levels that would occur as a result of mine approval are quite low. Indeed a net benefit on blood lead concentrations is anticipated as a result of the additional dust controls that would occur if the mine proceeds.
- The cancer risks from exposure to the metals of potential concern are very low.

Furthermore, lead intakes as a percentage of the TDI and associated blood lead levels at the most impacted receptor would be lower given the relocated processing plant. This is due both to lower maximum incremental lead concentrations due to emissions from the mine lease area, and due to the location of this receptor within zones of lower background lead concentrations in soil.

3.1.6 Conclusion

For all parameters and averaging periods, the maximum predicted incremental impact at the most affected sensitive receptor was predicted to be reduced compared to the original Project. Maximum predicted Preferred Project related increments across all receptors and modelling years are anticipated to represent:

- a 25% reduction in 24-hour average PM_{10} compared to the original modelling;
- a 50% reduction in annual average PM_{10} compared to the original modelling; and
- over 40% reduction in cumulative (baseline plus Project increment) annual lead concentration compared to the original modelling.

In all cases, lead deposition rates are predicted to be less than the maximum deposition rate across all receptors under the original modelling. The highest rate of lead deposition (0.20g/m^2/year at Receptor R27) is anticipated to be less than 55% of the maximum deposition rate under the original modelling (0.45g/m^2/year at Receptor R8).

Further, revised dispersion modelling indicates that the relocation of the processing area is anticipated to deliver a decrease in key air quality parameter increments to the majority of areas of significant population density.

With regard to evaluation of TSF 'Upset' conditions, modelling indicates that only those receptors in close proximity to the TSF, specifically R1 and R21-R24 along the southeast boundary, show a noticeable influence due to the variation between normal and upset operations of the TSF.

In all instances, and under the highly conservative assumption that any 'Upset' persists for up to 24-hours, DECCW air quality criteria are anticipated to be satisfied, even at receptors closest to the proposed TSF.

The selection of crusher configuration (full enclosure under negative pressure with all emissions vented to a baghouse versus acoustic cladding with hooded extraction) is not a critical factor in predicted concentrations from the Preferred Project.

It is considered that the conclusions made within the HHRA remain valid and represent an even more conservative approach when the incremental impacts of the proposed processing plant location are considered.

3.2 NOISE AND VIBRATION ASSESSMENT

BHOP engaged EMGA Mitchell McLennon (EMGA) to assess the construction and operational noise and vibration impacts associated with the Preferred Project, The *Noise & Vibration Assessment for the New Process Plant Location* (revised Noise & Vibration Assessment) (2010) is provided in ***Appendix C.*** The report and outcomes are summarised below.

The revised Noise & Vibration Assessment relies on the background noise information included in the *Noise and Vibration Assessment Reports* (ERM, 2007 and EMGA, 2009 respectively) provided in Annexure G(A) and G(B) of the EAR, as well as supplementary monitoring data captured in 2010.

3.2.1 Noise Criteria

Operational Noise Criteria

The Noise and Vibration Assessment reports in the EAR correctly adopted the INP to develop appropriate noise criteria. These are re-produced in ***Table 3-4*** for locations A1 to A10 and were derived on the basis of background noise plus 5dB. An explanation for the basis of criteria derivation is also provided for each assessment location. For the newer assessment locations A12 to A14, these are based on monitoring data collected in 2010.

Table 3-4: INP Project Specific Operational Noise Criteria

Receiver No	Location	Criterion, $L_{eq,15minute}$ dB(A)			Basis of Criteria Derivation
		Day	Evening	Night	(Refer to ERM 2007)
A1	Piper St North	38	37	35	Based on long term monitoring at M2 (148 Piper St). This also applies to the southern urban area of Broken Hill.
A2	Piper St Central	38	37	35	Based on long term monitoring at M2 (148 Piper St). This also applies to the southern urban area of Broken Hill.
A3	Eyre St North	44	41	39	Based on long term monitoring at M1 (139 Eyre St).
A4	Eyre St Central	44	41	39	Based on long term monitoring at M1 (139 Eyre St).
A5	Eyre St South	44	41	39	Based on long term monitoring at M1 (139 Eyre St).
A6	Bonanza & Gypsum Sts	48	41	39	Based on correlation of attended short term monitoring at this location and unattended long term monitoring at Eyre St.
A7	Carbon St	35	35	35	Based on long term monitoring at M4 (208 Carbon St). This also applies to the north west urban area of Broken Hill.
A8	South Rd	48	39	39	Based on correlation of attended short term monitoring at this location and unattended long term monitoring at Piper St (for daytime) and Carbon St (for evening and night).
A9	Crystal St	46	39	39	Based on correlation of attended short term monitoring at this location and unattended long term monitoring at Piper St (for daytime) and Carbon St (for evening and night).
A10	Garnet & Blende Sts	42	41	35	This also applies to the northern urban area of Broken Hill.
A11	Crystal St	46	39	39	Based on A9 since A9 and A11 are located along Crystal St.
A12	Crystal St	46	39	39	Based on A9 since A9 and A12 are located along Crystal St.
A13	419 Eyre St	38	35	35	Based on correlation of attended short term monitoring at this location and unattended long term monitoring data at M6 (immediately across Holten Dr from this location) in 2010.
A14	Piper St North	35	35	35	Based on correlation of attended short term monitoring at this location and unattended long term monitoring data at M6 across on Holten Dr in 2010.

1. The monitoring data and derived criteria for locations A1 to A10 are sourced from ERM 2007.

Sleep Disturbance Criteria

The above criteria, which consider the average noise emission of a source over 15 minutes, are appropriate for assessing noise from relatively steady-state sources, such as engine noise from mobile plant and processing equipment. However, noise from sources such as reversing alarms, truck tail gates banging and handling wagons are intermittent (rather than continuous) in nature, and as such, needs to be assessed using the L_1 or L_{max} noise metrics.

As part of the background noise monitoring, it was established that background noise levels for some residences are as low as 30dB(A). As such, the sleep disturbance criterion would be as low as 45 dB(A) L_{max} for some residences.

Construction Noise Criteria

It is accepted practice to adopt operational noise criteria for construction activities at 'brownfield' mine sites since such activities are often indistinguishable from mining type operations. However, the area proposed for the process plant is significantly removed and isolated from any current sources of noise on the site. Also, the nature of current site operations is mostly limited to underground mining with relatively little surface activities. This, combined with the location of potentially impacted receivers, suggests proposed construction noise is likely to be clearly distinguishable from any operations. Notwithstanding this, if operational noise limits can be satisfied, construction activities are normally permitted without restrictions. This is discussed further in Section 3.2.2 of this report.

The Interim Construction Noise Guideline (DECCW, 2009) (ICNG) is specifically aimed at managing construction works regulated by the DECCW under the *Protection of the Environment Operations Act 1997* (POEO Act). This provides the current and most relevant guidance for construction noise assessment.

The primary management measure is to undertake construction during daytime hours only, which will be adopted for this Project in the most part. The ICNG recommends works are restricted to:

- Monday to Friday, 7.00 am to 6.00 pm;
- Saturday, 8:00 am to 1:00 pm; and
- no construction work to take place on Sunday and public holidays.

Broken Hill is a remote location in New South Wales. During construction BHOP will require some degree of contract labour from intra- and inter-state. To accommodate contractor travel arrangements and to limit the time contractors may be away from their families, BHOP proposes to undertake construction work from 7am to 7pm, seven days a week. This will also have the benefit of reducing the duration of the construction activities.

3.2.2 Predicted Noise and Vibration Levels

Construction Noise

The construction of the surface processing facility will typically entail two broad stages of construction. The first stage will be establishment of the ROM pad area and includes civil works using equipment such as excavators, backhoes, tip trucks, compactors, generators, mobile cranes (10T to 50T capacity), agitator trucks and concrete vibrators. The expected duration of this stage of construction is 26 weeks.

The second stage will be the structural phase, including mechanical works, piping and electrical works. Typical equipment needed will include mobile cranes (10T – 100T capacity), generators, welding machines, semi trailers, small trucks and hand-held grinders. The expected duration of this stage of construction is 18 weeks. An estimated 12 months has been provided for the total construction period to allow for interruptions from weather and downtime.

The results of construction noise predictions demonstrate that typical construction activities are expected to satisfy the adopted ICNG criteria at all representative residential locations. To that end, predicted noise levels are generally below background noise levels at corresponding residential locations and well below INP based operational noise targets for both the daytime and evening

periods. Hence, the extension of construction hours to between 7:00 am and 7:00 pm seven days per week is considered reasonable.

The change in location of the processing plant has moved the construction noise sources away from highly populated areas in Broken Hill South to areas with few residences. Previously the worst-case noise was predicted at receptor A4 at 40dB(A). The predicted highest noise levels from construction activities are now for receptor A12, which is a commercial area at Crystal Street. The predicted criterion noise levels are now contained within the lease or are distributed over vacant land (Perilya Mining Lease) towards the quarry where there are no residences.

Operational Noise

This section provides the results of noise predictions for the proposed operations with the process plant in its new location and rail loading at the northern most end of the site.

The mitigation and management of noise emissions outlined in the previous assessments will be incorporated in the current design where these are still relevant. These include the following items:

- positioning the process plant in a natural depression on site;
- cladding of the primary crusher and installing noise abatement bunding to the north and south of the crusher;
- covered conveyors and transfer stations;
- building around the flotation facility providing shielding of the SAG and Ball mills;
- suppression on the front-end-loader;
- suppression on the forklift used at the wagon stockpile area and the rail loading;
- bunding along the southern side of the mine truck haul route and the southern perimeter of the ROM pad;
- two overlapping bunds at the northern side of the wagon stockpile area to shield Crystal Street residences;
- limiting crushing to daytime only; and
- limiting rail shunting and loading to daytime only.

With the above measures in place, the operating scenarios were modelled for the new location of process plant, truck haulage and rail loading.

The results of noise modelling are tabulated in ***Table 3-5***. As per the original operational noise assessment, the daytime predictions were for calm weather conditions and the night-time predictions are for calm and temperature inversion conditions, even though inversions were found not to be a 'feature' of the area as defined by the INP.

The results demonstrate that predicted noise levels will satisfy INP criteria at all nominated assessment locations. This is illustrated on the noise contours on ***Figure 3-1***, where the contours are well below INP criteria at all populated areas of Broken Hill. To that end, the contours demonstrate that the noise exposure of residences from the proposed operations is relatively well contained and the minimum noise criterion level of 35dB(A) is generally limited to the site boundary.

Table 3-5: Predicted Operational Noise Levels

Location		Predicted $L_{eq,15min}$ Noise Level, dB(A)			Previous Results (ERM 2007)			INP Operational Criteria, dB(A)		
		Daytime	Night time		Day	Evening	Night	Day	Evening	Night
		Calm	Calm	Temp. Inv. 3^0C/100m						
A1	Piper St North	<35	<35	<35	34	30	30	38	37	35
A2	Piper St Central	<35	<35	<35	39	37	37	38	37	35
A3	Eyre St North	37	37	38	40	40	40	44	41	39
A4	Eyre St Central	<35	<35	<35	42	40	40	44	41	39
A5	Eyre St South	<35	<35	<35	42	37	37	44	41	39
A6	Bonanza & Gypsum Sts	<35	<35	<35	46	42	42	48	41	39
A7	Carbon St	<35	<35	<35	37	33	33	35	35	35
A8	South Rd	<35	<35	<35	37	33	33	48	39	39
A9	Crystal St	<35	<35	<35	37	36	36	46	39	39
A10	Garnet & Blende Sts	<35	<35	<35	33	36	36	42	41	35
A11	Crystal St	<35	<35	<35	NA	NA	NA	46	39	39
A12	Crystal St	39	<35	39	NA	NA	NA	46	39	39
A13	Eyre St North 2	37	<35	<35	NA	NA	NA	38	35	35
A14	Piper St North	<35	<35	<35	NA	NA	NA	35	35	35

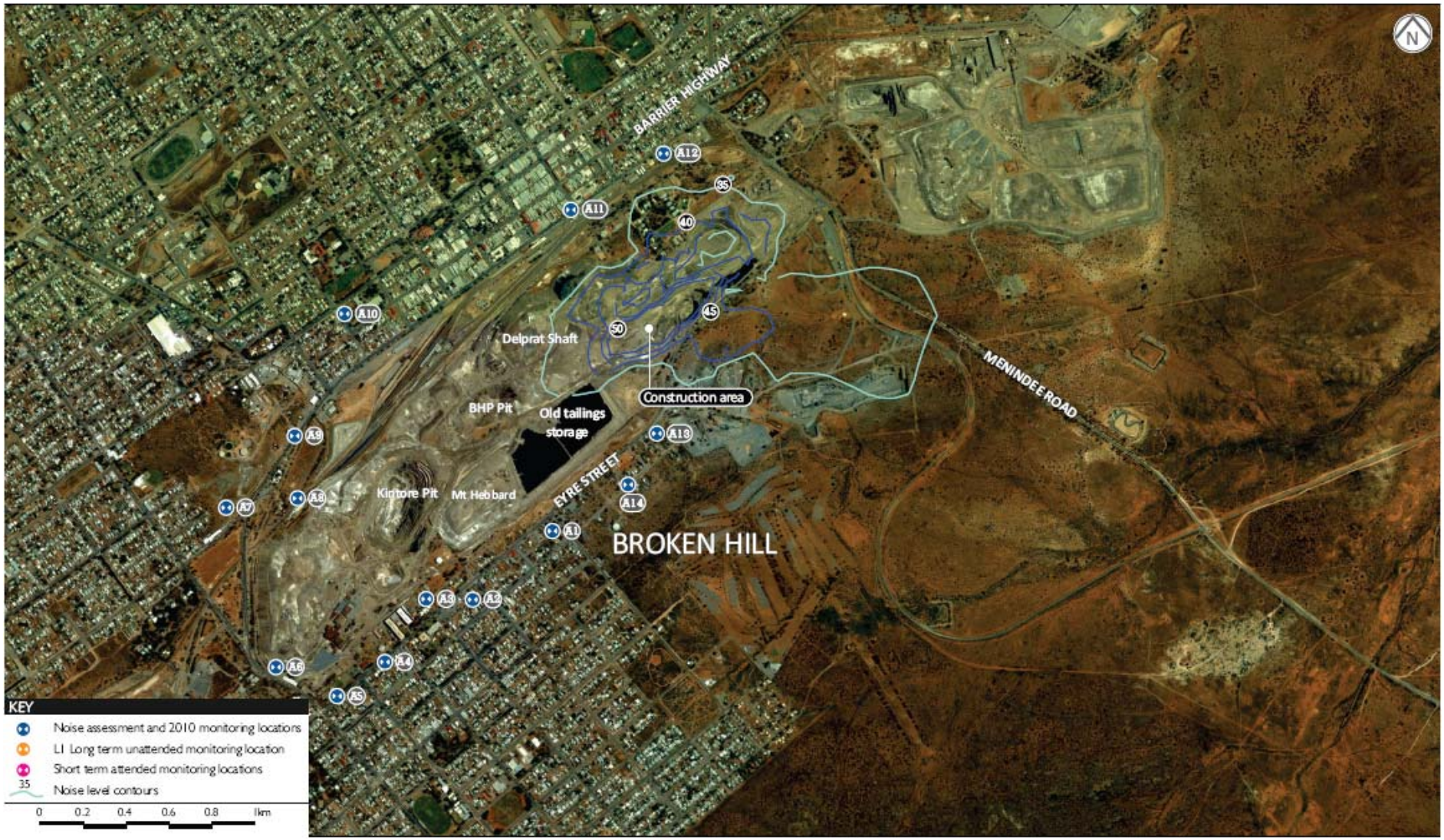

Figure 3-1: Day Time $LA_{eq\ 15\ mins}$ Operational Noise Contours dB(A)

Another important note is that the current noise level predictions are clearly a significant improvement on those of the previous situation as a consequence of the new location of the process plant and rail loading facilities. This is reflected in the lower noise levels predicted for locations A2 to A10 as shown in ***Table 3-5***.

Sleep Disturbance

An assessment of intermittent noise sources was undertaken with the primary focus being on activities associated with wagons being loaded and unloaded by forklift at the wagon stockpile area at night. Typical sound emission factors for maximum noise events was used for modelling purposes (eg 120dB(A) sound power level). Based on this emission factor, ***Table 3-6*** presents results of predicted noise levels at nominated assessment locations for the night-time assessment period and during adverse temperature inversion conditions.

The predicted Lmax noise levels satisfy the strict sleep disturbance criteria at most residential locations assessed. The exception is a minor (1dB) exceedance of strict criteria at locations A11 and A12, which represent areas in the northern parts of the town. This is considered to be a very minor level of exceedance that will not be noticeable in reality. All feasible and reasonable noise mitigation is considered to have been applied to reduce this result and includes two 4 metre high overlapping earth bunds to the north of the concentrate truck haulage route and wagon stock pile area. The number of events of such Lmax noise for any given night could be in the order of five to ten, and is therefore considered relatively minor in quantity.

It is also important to note that the new location of the plant has resulted in a significant reduction in maximum noise levels at receivers as can be seen when comparing the 2007 assessment results to the current results in ***Table 3-6***.

Table 3-6: Predicted Lmax Noise Levels

Location		Predicted Lmax Noise Level, dB(A)	Previous Result (ERM 2007)	Lmax Criteria, dB(A)
A1	Piper St North	28	42	45
A2	Piper St Central	26	51	45
A3	Eyre St North	21	52	49
A4	Eyre St Central	22	45	49
A5	Eyre St South	22	46	49
A6	Bonanza & Gypsum Sts	20	39	49
A7	Carbon St	29	49	45
A8	South Rd	18	46	49
A9	Crystal St	23	50	49
A10	Garnet & Blende Sts	40	53	45
A11	Crystal St	**50**	NA	49
A12	Crystal St	**50**	NA	49
A13	Eyre St North 2	32	NA	45
A14	Piper St North	29	NA	45

3.2.3 Conclusion

The results of the revised Noise & Vibration Assessment demonstrate that noise levels projected to be generated by the Preferred Project are expected to generally satisfy current construction and operational noise guidelines and relevant DECCW criteria at the nominated representative receivers. A comprehensive list of noise mitigation and management measures have been identified and will be adopted to ensure noise emissions are minimised.

The revised assessment clearly demonstrates that the new location of process plant and consequent changes to haul roads and rail loading operations has resulted in a significant reduction in predicted noise levels for the Broken Hill community when compared to the original Project.

3.3 STORMWATER ASSESSMENT

BHOP engaged Golder Associates Pty Ltd (Golder) to undertake an *Amendment to the Surface Water Management Plan for the New Plant Location* (amended SWMP) (2010) to identify the surface water management measures required for the Preferred Project. A copy of the amended SWMP is provided in ***Appendix D***.

The new location of the processing plant, haul roads and rail load-out area will not change the majority of the catchment areas and associated stormwater management structures proposed in the original SWMP (included in Annexure J of the EAR). However, the Preferred Project will require four catchment areas to be re-configured and four new sedimentation dams to be constructed. The modified surface water management measures are generally concentrated around the new processing plant location and the rail load-out area. ***Appendix D*** provides a detailed discussion of the proposed changes to individual catchment areas and water management structures.

As with the original Project, potential impacts of the Preferred Project will be mitigated by implementation of SWMPs. A series of revised SWMPs applicable to the Preferred Project are included in ***Appendix D***.

Golder has indicated that the catchment modifications required as part of the Preferred Project are minor and will not invalidate the hydrological modelling that was undertaken as part of the original SWMP. It has been confirmed that the available capacity of the Horwood Dam remains sufficient to hold a 100 year storm event.

In order to prevent discharge of surface waters from the site and minimise erosion and sedimentation, BHOP will implement the surface water management measures recommended in the amended SWMP, detailed in Section 10.6 of the EAR and committed to in the Statement of Commitments (**Appendix A**).

3.4 VISUAL ASSESSMENT

The Project Area is considered to be an integral part of the visual and heritage character of Broken Hill and can be viewed from many parts of the town. Changes to the viewscape resulting from the Preferred Project will be relatively minor and in some cases will result in a reduction in visual amenity impacts when compared to the original Project.

This includes views to the north from road users and residents directly to the south and south-west of the mine. Under the original Project layout, these receptor locations had views to processing plant and associated infrastructure, including the ROM pad. The viewscape for these receptors will now remain the same as the current situation.

The preferred plant location is also shielded from view by road users and the few residents to the east and north-east of the mine. This has been achieved by positioning the plant in a depression and constructing noise abatement bunding along the southern perimeter of the ROM pad and along a section of the haulage and cartage roads. Cross-sections illustrating the topography from Holten Drive are provided in ***Figure 2-3***.

Some components of the processing plant infrastructure may be viewed from residents to the north of the mine and road users along Crystal Street. However, the impacts are not considered significant due to their proximity to the mine (distant views) and their existing outlook across Crystal Street and the Broken Hill railway station associated infrastructure and current mine buildings.

Overall, the visual impacts associated with the Preferred Project would be less than the original Project and would remain relatively minor.

3.5 MINE CLOSURE

The original processing plant was located in the south-west area of CML7 adjacent to historic mine buildings and structures. The majority of these buildings and structures such as the headframes (Shafts 7 and 4) that are visible from many areas in Broken Hill, are listed in the BHCC Local Environment Plan as historically significant. Prior to the purchase of the Mine the area was used as a tourist operation by the Line of Lode Association with walking tours through the area. Much of the signage and dioramas still remain.

BHOP will continue to reuse some of the buildings in this area as outlined in Chapter 11 of the EAR.

BHOP is currently in consultation with the Department of Environment Water Heritage and the Arts as to the final outcome of many of these buildings and structures to support the BHCC's application for national heritage listing. .

Chapter 17 of the EAR stated that the aim for rehabilitation and mine closure of the original Project is to reconstruct landforms that are stable and safe, and support post-Project land use of tourism. This aim remains relevant for the Preferred Project.

The specific aims of rehabilitation and mine closure for the Preferred Project are:

- retain heritage items (as agreed with BHCC and DEWHA);
- manage stormwater to minimise erosion and restrict the potential for off-site pollution;
- provide final landforms that are safe, stable and sympathetic to the mining heritage of Broken Hill;
- minimise dust generation and adequately contain potentially hazardous material within the landform; and
- install barriers to restrict access to potentially hazardous locations (i.e. decline, shafts or open cut pits).

The rehabilitation, final landform and mine closure strategies detailed in Chapter 17 of the EAR remain relevant to the Preferred Project.

4 ADDITIONAL CONSULTATION

A consultation program has also been implemented, and is continuing to be implemented, in order to inform the local community and relevant stakeholders about the Preferred Project. Details of the consultation program are included in the PPR and key actions undertaken to date are summarised below:

- A series of meetings with key government agencies to inform them about the Preferred Project and the results of additional noise and air modelling. Meetings have been held with representatives from the following agencies:
  - I&I NSW;
  - DECCW;
  - Greater Western AHC and NSW Health;
  - BHCC; and
  - DoP.
- A series of meetings and/or phone calls with service providers, to inform them about the Preferred Project and discuss the provision of the relevant services to the new processing plant location. Meetings have been held with representative from the following service providers:
  - Australian Rail & Track Corporation (ARTC);
  - Country Energy;
  - Country Water.
- A dedicated Consultation Group meeting to review and discuss the Preferred Project;
- Meeting with representative from Perilya Broken Hill Operations Pty Ltd, the owner and operator of the neighbouring Perilya Broken Hill Mine and the owner of 'Proprietary Square' which is a small building development located to the north-west of the site;
- The Mine Manger was interviewed on local ABC radio to provide a brief outline of the proposed changes.

Feedback from government agencies and stakeholders about the Preferred Project has been positive with all parties commending BHOP for efforts to further reduce environmental impacts associated with the Project.

In addition the consultation actions outlined above, it is understood that the DoP intend to exhibit this PPR for a period of two weeks. This will ensure that all community members are informed about the Preferred Project and given the opportunity to comment.

5 CONCLUSION

BHOP has investigated alternate process plant locations at the north-eastern end of the lease, further away from the densely populated residential areas in the south and BHOP has identified a new location adjacent to Blackwood Pit. This location lies opposite an operating hard rock quarry and other industrial / commercial businesses, with the Perilya North Mine to the east. Few residential properties are located in or near this area

The key driver for the relocation of the processing plant is to reduce environmental impacts, primarily associated with air quality (dust) and noise from the processing plant operations.

BHOP has also optimised the processing design with the removal of the secondary and tertiary crushers and associated screens thereby removing major sources of dust and noise generating activities.

This PPR outlines the proposed changes to the Project and the subsequent reductions in environmental impacts. Revised air quality, noise, stormwater and visual assessments undertaken as part of the PPR clearly demonstrate that significant environmental advantages will be achieved by relocating the processing plant and rail loading facility to the north-eastern end of the lease.

In summary, the Preferred Project will achieve:

- A reduction in the maximum predicted incremental air quality impact at the most affected sensitive receptor for all parameters and averaging periods, when compared to the original Project, including:
  - a 25% reduction in 24-hour average PM_{10};
  - a 50% reduction in annual average PM_{10}; and
  - over 40% reduction in cumulative (baseline plus Project increment) annual lead concentration;
- A predicted maximum rate of lead deposition less than 55% of the maximum deposition rate under the original modelling;
- A decrease in key air quality parameter increments to the majority of areas of significant population density;
- Significant reductions in predicted noise levels for the Broken Hill community when compared to the original Project; and

In addition similar or reduced affects are expected on stormwater, visual amenity, greenhouse gases, groundwater resources, heritage, ecology, traffic and transport, waste, socio economic, rehabilitation and final landform when compared to the original Project.