Appendicies

Section 8 – Environment and Social Impact Assessment

8.1-A Socio-economic Impact Assessment
8.3-A Construction Noise and Vibration Management Plan
8.3-B Hillside Mine Blasting Impact Assessment
8.3-C Hillside Mine Mobile Plant Headlight Line of Sight Assessment

FINAL

Socio-Economic Impact Assessment

Hillside Project

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SOCIO-ECONOMIC IMPACT ASSESSMENT

Executive Summary

Rex Minerals Limited (Rex) proposes to develop the Hillside copper-gold project (the Project), 12km south of the town of Ardrossan on the Yorke Peninsula, South Australia.

The project will involve open-cut mining of the copper belt to access copper, gold and iron ore. Mining will occur over approximately 15+ years, and all concentrates will be shipped from the Port of Ardrossan and exported to overseas markets. Project infrastructure will include a concentrate pipeline from the mine site to the port, a distance of approximately 10 km.

It is anticipated that the peak construction workforce may total approximately 1,000 workers. Operations will require a lesser workforce, made up from a combination of direct employees and service supply contractors. An average workforce of about 532 persons will operate the mine over its 15+ years. The majority of workers are expected to be accommodated in existing or new accommodation within local communities located daily driving distance of the mine.

The socio-economic impact assessment (SIA) considered eight social aspects that may be impacted by the Project. They were:

1. Land use
2. Employment
3. Local population
4. Health and wellbeing
5. Community services and facilities
6. Infrastructure
7. Housing and accommodation
8. Economy.

The SIA identified 27 potential socio-economic impacts. Eight were assessed as having a potentially moderate negative rating, relating to land values, accommodation and housing, regional competition for skilled labour and local population. There were no potential impacts that received a negative residual rating of major or extreme. Some impacts which have been rated negatively also have a potentially positive aspect and where this occurs, this has been indicated in the impact rating tables (tables 07 to 14). Seven solely positive potential impacts were identified in the areas of employment, community participation and local economy.

The SIA drew on characterisation data compiled within a baseline characterisation report prepared in 2012 (DMC 2012) and data supplied by Rex.

It is the view of those involved in this SIA that with:

- careful planning by the Project team that considers the experiences of other mining projects set within a similar context to Hillside
- continued robust community participation
- ongoing coordination and planning with local and State Government agencies
- particular attention paid to the development of strategies to manage accommodation requirements and road safety
- effective implementation of the management measures outlined herein
- the potential negative impacts of the Hillside Project can be minimised to an extent that they are outweighed by the potential benefits.

1 Introduction

1.1 Background

Rex proposes to develop the Hillside Project, 12km south of the town of Ardrossan on the Yorke Peninsula, South Australia.

1.2 This Report

Rex commissioned the compilation of a socio-economic baseline characterisation (DMC 2012) in preparation for possible future environmental and social impact assessment of the Hillside Project. The socio-economic baseline characterization described the current socio-economic environment in the Project area and the region more broadly. It is Rex's intention to apply to the South Australian Government for a Mining Lease for the Project.

Rex subsequently commissioned DMC to prepare this socio-economic impact assessment to identify and describe potential impacts, conduct a residual impact rating assuming the recommended management measures are in place and to outline expected outcomes and the monitoring regime for the ongoing management of socio-economic impacts. This socio-economic impact assessment draws on the socio-economic baseline characterisation against which to predict the potential socio-economic impacts of the Project.

The objective of this socio-economic impact assessment report is to demonstrate that Rex understands and has in place effective management measures with which to manage the potential socio-economic impacts of the Project, minimising the potentially negative effects and maximising the benefits of the Project in the immediate area and the region more broadly.

1.3 Study Area

The socio-economic impact assessment uses the same study area defined in the socio-economic baseline characterization. It used a two-tiered study area recognising that while the majority of potential impacts (positive and negative) would be felt locally, the Project would also have an effect on the region more broadly. The definitions of each study area from the socio-economic baseline characterization are repeated below (DMC 2012).

1.3.1 Primary Study Area

The primary study area is defined by the boundaries of the ABS Census Postal Area of 5571, which includes the townships of Ardrossan, Black Point, James Well, Pine Point, Port Julia, Rogues Point, Sheaoak Flat and Tiddy Widdy Beach.

The township of Ardrossan, the largest town in the primary study area, is located approximately 165km by road from Adelaide on the mid-eastern coast of the Yorke Peninsula, approximately 12km north of the Hillside Project site (see Figure F01 for location). Due to its close proximity to the Project site, Ardrossan is the nearest sizable residential community from which a local workforce is most likely to be sourced (to the extent possible) and accommodated, and from which available goods and services will be procured. It will likely experience the greatest level of activity associated with the Project and thus is the town most likely to experience the greatest impact (both positive and negative) associated with the Project. It is noted, however that the coastal settlements of James Well, Rogues Point and Pine Point are located between Ardrossan and the Project and that Pine Point is the closest residential community to the Project.

Their proximity to the Project means those communities will also be impacted by aspects such as Project traffic and potentially noise and dust from the Project, in some cases possibly even to a greater extent than Ardrossan. But because those communities are residential only and rely on Ardrossan as the regional hub for retail, physical and social services, the breadth of impact at Ardrossan is likely to be greater, and is the point of source for broader impacts across the primary study area.

1.3.2 Regional Study Area

The regional study area is defined by the Goyder state electoral division (SED) boundaries, as illustrated in Figure F01. Goyder SED is made up of the district councils of Yorke Peninsula, Copper Coast, Barunga West (part), Wakefield Regional Council (part) and Mallala (part).

This study area has been chosen as the second-level study area because it reflects the residential settlements within a reasonable daily driving distance of the Project (an actual kilometre radius has not been defined, because it is considered that a range of factors will influence residents' choices about how far they are prepared to drive to work at the Project and Rex is yet to define its roster, transportation and health and safety requirements that will facilitate or constrain residents' daily driving options). At the southern end of the Goyder SED is the town of Yorketown, located approximately 80km from Ardrossan (less than 70km from the Project site), at the north western boundary of the SED is Wallaroo, located approximately 68km from Ardrossan (80km from the Project site), and at the south eastern boundary of the SED is Dublin, located approximately 90km from Ardrossan (102km from the Project site).

Given the Goyder SED boundary is considered to represent the reasonable daily driving distance for workers associated with the Project (directly or indirectly), it is considered the reasonable area in which the primary spread of impact and benefit from the Project will manifest. Further, using a SED aligns with ABS Census data, allowing for the analysis of a large range of social indicator data and comparison over time.

Within the Goyder SED, the District Council of Yorke Peninsula (DCYP) is the local council area most relevant to the Project; it is the local council area in which the Project is located. Where data is included in this report that can only be obtained at a local council level (ie, not through ABS Census data), such as been included as it pertains to DCYP.

1.3.3 South Australia

Data representing the entire state of South Australia is included for comparison of local data against State averages and to indicate the potential effect of the Project at the State level.

1.3.4 Australia

Data representing the nation of Australia has also been included for comparison of local and State data against national averages and to indicate the potential effect of the Project at a national level.

1.4 Impact Assessment Approach

The socio-economic impact assessment approach involves:

- Consideration of potential, credible social issues associated with the Project during all phases and consequent potential, credible impacts within the context of the existing conditions.
- Identification of appropriate management measures, where the measures described are technically and economically feasible within the context of the Project.
- Assessment of credible (i.e., they are assumed to occur during the life of the Project) residual impacts, assuming the successful implementation of the management and mitigation measures.

1.4.1 Impact Identification

Sources of impacts were systematically identified by considering project aspects or hazards and credible potential incidents or events. Potential consequences of an incident or event were then considered and social communities, items or areas affected were defined. Finally, credible social impacts with respect to each community, item or area were determined and assessed.

In this chapter, impact identification considers impacts during three phases of the Project – construction, operation, decommissioning and closure.

1.4.2 Assessment of Significance

The assessment of residual impacts (assuming the effective implementation of (i) avoidance, mitigation and management measures for adverse impacts, and (ii) measures to optimise benefits) was conducted by examining both the magnitude of the impact and the sensitivity of the receptor being impacted, i.e., the impact's significance. This interaction between magnitude and sensitivity is expressed in a matrix form, thereby bringing a transparent structure to complex interactions.

Analysis of the likelihood of the impact has not been included in this assessment, since the impacts described are all viewed as being credible outcomes of the Project.

1.4.3 Magnitude of Impact

The magnitude of an impact is defined as the amount and type of change, including the severity, geographic extent and duration of the impact:

- Severity: considers the scale or degree of change from the existing situation as a result of the impact; severity can also be considered in terms of the intensity of the impact, and can be positive or negative.
- Geographic extent: considers if the effect is national (or international), regional, local or limited.
- Duration: considers the timescale of the effect, i.e., if it is temporary, short term or long term. This takes into account reversibility of the effect, where an irreversible impact is one where recovery on a reasonable timescale is not possible.

The specific criteria for defining the magnitude of an impact used for this assessment are provided in Table 01.

Table 01 Criteria for magnitude of impact

Consequence Category		Low	Medium	High
Severity of impact	Social	Minor impact; attracts stakeholder concern at a local level. Isolated complaints to project which can be immediately resolved. No disruption to operations.	Substantial community effect; results in stakeholder concern at a provincial level. Persistent community complaint to project or regulator that may require review and change in process. Salvage of significant heritage items. Potential for interruption to operations.	Major community effect; permanent loss of major community amenity; results in stakeholder outrage (media, shareholders, governments, international NGOs) at a national or international level. Closure of operations. Major litigation or prosecution.
	Economic	Impact on individual income.	Impact on local economy.	Impact on State or National economies.
	Health	Health effects to one or more people requiring first-aid treatment or having low-level impacts on quality of life or well-being.	Health effects to one or more people requiring medical treatment and/or hospitalisation, exacerbating existing illness or causing quality of life impacts with respect to physical and mental health.	One or multiple fatalities; permanent (irreversible) disablement or incapacitation to more than 10 people.
Geographic extent		Effects confined within the Project footprint or to a small, isolated location(s) outside the Project area.	Effects extend beyond the area of impact to the broader district or State.	Effects are widespread, to more than one State or the nation.
Duration		Temporary or short-term effects will alleviate within 3 years.	Effects will alleviate in the medium-term (up to 10 years).	Effects are either long-term (more than 10 years) or permanent, i.e., changes not able to be practically or significantly reversed or alleviated.

1.4.4 Sensitivity of Receptor

Sensitivity is defined as the susceptibility of the society to change, including its capacity to adapt to, or accommodate, the kinds of changes that the Project may bring about. This definition reflects:

- The formal status of the community, item or area being impacted, for instance, statutory or attributed protected status, social standard or recognition, e.g., does the community, item or area being impacted have local, regional, national or international recognition or status?
- Its iconic or symbolic importance to cultural value systems.
- Its importance to society and the community.
- Its vulnerability to material damage or loss.

The specific criteria for sensitivity used in this assessment are provided in Table 02.

Table 02 Criteria for sensitivity

Sensitivity	Low	Medium	High
Formal status/value; importance to society and community.	Zero importance or only local value or recognition.	A regional or provincial recognised site or value.	A critical asset, national or international recognised site or value. Iconic or symbolic importance to cultural value systems.
Vulnerability	Easily adaptable to change (or no change required).	Some resilience to change.	Limited or no capacity to adapt to change.
	Community, item or area is already affected by this impact, prior to project development.	Some sign of exposure to this impact is already evident in the community, item or area prior to project development.	Community, item or area is unaffected by this impact prior to project development.

1.4.5 Impact Assessment

Prior to the impact assessment, management measures were applied to reduce impacts to as low as reasonably practicable, i.e., it is assumed that the stated management measures are effectively implemented. The assessment was then based on the following:

- Comparison of predicted, project-derived values with objective, quantitative or qualitative criteria or standards for those aspects of the Project where such criteria or standards were available. Where appropriate, non-compliance was further assessed in terms of actual impacts and the need for additional management measures, where required.
- Assessment of impact significance by referring to statutory or nationally or internationally accepted authorities where available.
- Assessment of impact significance using either:
  - The criteria for the magnitude of impact and sensitivity of receptors, as described in Tables 01 and 02 respectively.
  - More detailed, issue-specific criteria developed by the various specialists as required. Such criteria were developed to be consistent with the general approach i.e., consideration of the magnitude of an impact and the sensitivity of the community, item or area.

Residual impacts were then ranked as negligible, minor, moderate, major or extreme using the impact assessment matrix in Table 03 or a variation of this matrix, e.g., a five by five matrix was considered more appropriate for certain issues.

Table 03 Matrix of significance

	Sensitivity		
Magnitude of Negative Impact	**High**	**Medium**	**Low**
High	Extreme	Major	Moderate
Medium	Major	Moderate	Minor
Low	Moderate	Minor	Negligible
Positive	Positive	Positive	Positive

In relation to Tables 01 and 02, not all of the criteria defined for magnitude and sensitivity were applicable to every situation, with the result that application of the model criteria produced

inconsistent results. For example, impacts that are widespread (i.e., defined by Table 01 as having high consequence) may also be temporary and/or easily alleviated (i.e., defined by Table 01 as having low consequence). Where such instances were apparent, those criteria that were most relevant have been used with appropriate explanation.

Only the magnitude of an impact, i.e., the degree of change, geographic extent and/or duration of an impact can be reduced, as necessary, by application of engineering or other mitigation measures. However, the sensitivity of the community, item or area, as assessed, is fixed and is not changed by project activities. The resultant residual impact, therefore, reflects the reduction in magnitude that can be achieved by the proposed mitigation.

Positive impacts can also result from project activities. In this circumstance, such impacts have not been ranked but were assigned as a 'positive impact' for simplicity (see Table 03) and discussed, assuming that measures to optimise benefits were effectively implemented, as described. Some impacts which have been rated negatively also have a potentially positive aspect and where this occurs, this has been indicated in the impact rating tables (tables 07 to 14).

2 Potential impacts

Potential, credible, project-related socio-economic impacts associated with the Project during all phases are described below. These impacts are described with regard to the primary study area as described in Section 1.3 Study Area unless otherwise referred to as regional or state impacts. Potential impacts are described as they could occur if no management measures were implemented. Rex proposes to implement the proposed management strategies outlined in Section 3, Management strategies, which will result in the residual impacts discussed in Section 4, Impact assessment.

2.1 Land use

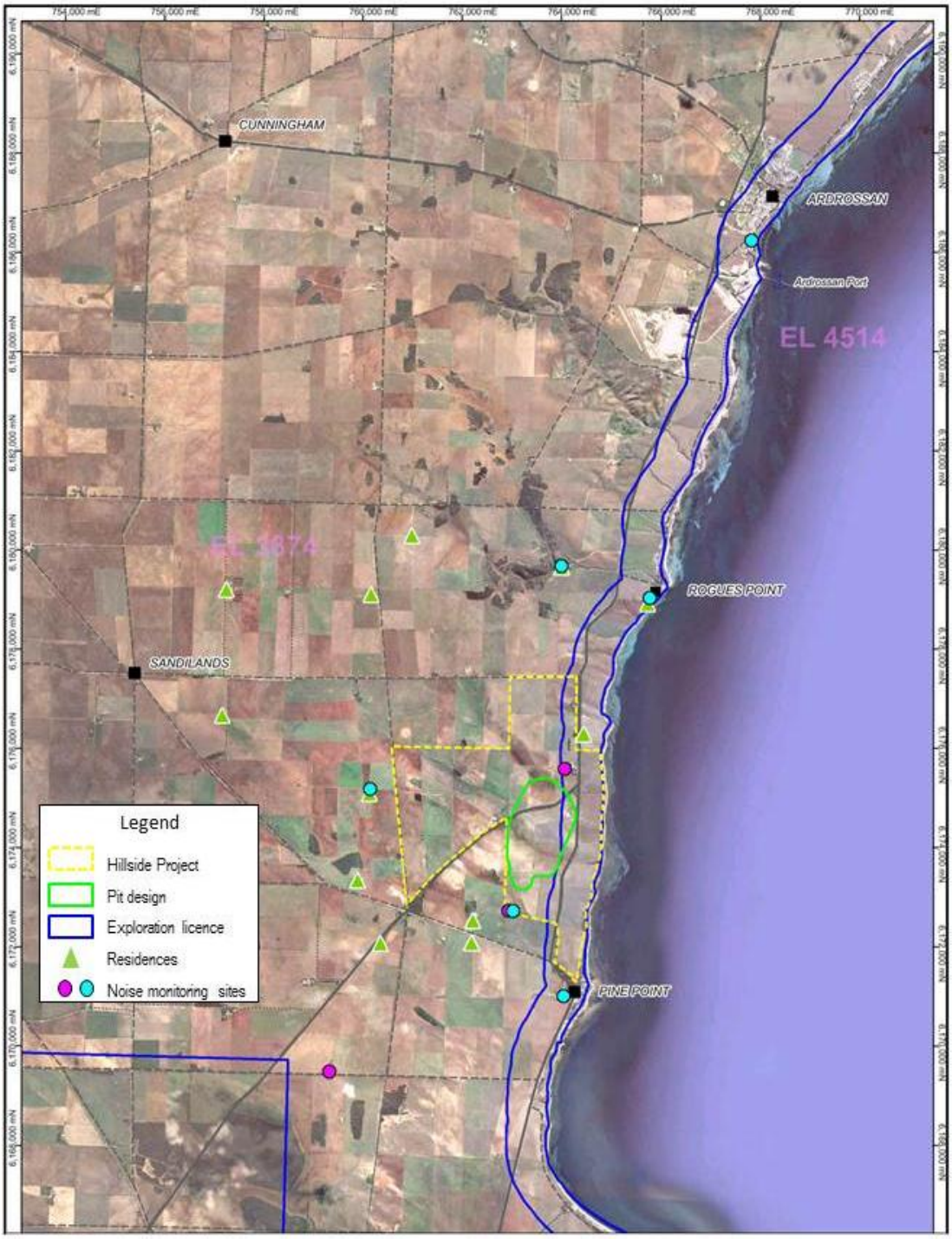
The land defining the main Hillside resource within EL 5055 is owned by Rex Hillside Property and negotiations are being held to purchase additional land required for mine-related infrastructure in this area. Land purchased by Rex included three residences and all but one resident has relocated. It is anticipated that three other dwellings (one in which a relocation agreement has been reached) will be vacated as a result of Rex's operations and will relocate when land purchase and/or agreements have been finalised There are five residences on land not currently owned by Rex located within a 1.5km radius of proposed mining activities. All of these residences are within the Mineral Claim area (Refer Figure 01, Nearest residences). Land use within and adjoining the Mineral Claim is agricultural including broad acre cropping and grazing.

2.1.1 Inconvenience to adjoining landholders

Adjoining landholders will be, or will perceive to be, inconvenienced by the nature and occurrence of Rex's activities relating to mining. The nature of Rex's activities is likely to result in elevated dust, light and noise from mining and associated activity, vibration from blasting within the pit and increased human presence and traffic to, from and around the site, that will, or will be perceived to, cause inconvenience to adjoining landholders.

Impacts of air emissions, noise, light and vibration are discussed in greater detail in the environment section of the Mining Lease Proposal (Rex 2013).

Figure 01 Nearest residences



2.1.2 Reduction in aesthetic value from change in existing land use

Adjoining landholders and those with a line of sight to the Project are likely to perceive and/or experience a reduction in aesthetic value of the area impacted by mining activity due to landform

change, disruption of sea views, increased lighting, visual impact of dust, removal of vegetation including pasture and cropped land, and loss rural farming landscape.

2.1.3 Changes to land value and industry types within region

Whilst much exploration activity occurs on the Yorke Peninsula and a dolomite mine (now operated by Arrium Mining), operates less than three kilometres south of Ardrossan, the Rex project signals the first new major mining project on the Yorke Peninsula since the operation of the Moonta copper mines on the west coast and greater diversification of industry types in the region. Land values are likely to change as a result of the Hillside Project: precedence across Australia suggests that towns and cities near to major mining and resources regions experience a general increase in land values (as demand meets or outstrips supply, refer to Section 2.7 Housing and accommodation)(REIA 2009). The effect on values of agricultural properties immediately adjacent to mining projects (generally) has not been conclusively demonstrated to be either negative or positive (but rather seems to depend on the nature of the mining operation, its land and water management practices, visibility and the effect is has on nearby amenity and impact on the agricultural productivity of the land rather than determined by the industry generally). Nevertheless, adjoining landholders may perceive that their property value is decreased as a result of the Project.

Expansion of mining on the Yorke Peninsula will add diversity to the industrial profile of the area. Given the existence of heavy industry on the peninsula already, the expansion of mining is not expected to have a negative effect on tourism in the region and may be perceived to provide greater opportunities in the form of industrial tourism.

2.1.4 Disturbance or damage to heritage

The Hillside Project site contains numerous heritage items that will require salvage. An Aboriginal Collaborative Heritage Agreement between Narungga Nations Aboriginal Corporation and Rex has been finalised for exploration and an agreed management plan and associated procedures for heritage surveys is in place.

There are no natural or man-made features of historical value within the Project site that have the potential to be disturbed or damaged as a result of the Project and while there are several cultural assets in the vicinity of the Project site, none are likely to be affected by Project activities.

2.2 Employment

2.2.1 Increased employment

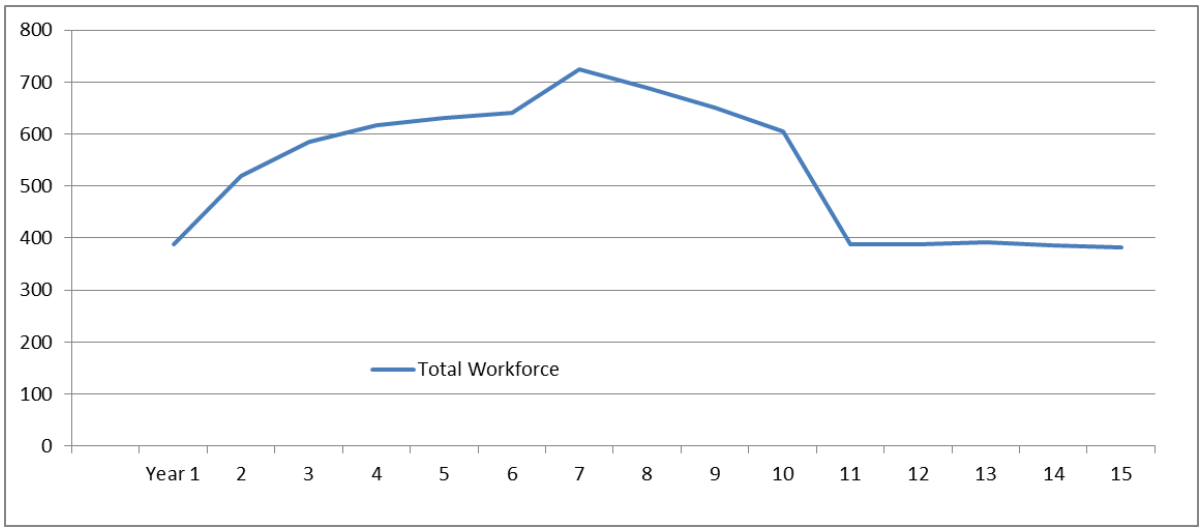
Direct employment

The Hillside Project is expected to employ approximately 725 people at its peak in year seven of the Project. The average workforce over the first 10 years, while open cut mining occurs, is 605 people, reducing to an average of 387 over the subsequent five years, while processing of stockpiles occurs. The average workforce over the 15+-year mine life will be 532 people and this number has been used herein as the basis for predicting potential employment-related impacts (such as indirect employment, population and accommodation). The Project workforce will decrease to about 382 people as it reaches its estimated mine life of 15+ years. During the construction phase the employment numbers are expected to range between 500 to 1,000 depending on the construction method (modularisation) and construction stages.

Figure 02, Workforce distribution during operation, shows the workforce distribution over the Project's life.

Of note is the sharp reduction in employment between years 10 and 11, when the required workforce will reduce by more than 40% (217 positions). This is when open cut mining is forecast to be completed and the mining method reverts to underground. At the end of the mine's life (estimated at 15+ years from commencement without the discovery and delineation of additional reserves), a significant portion of the remaining workforce (estimated to be 382 at year 15) would no longer be required as the mine moved into closure and decommissioning and, later, care and maintenance. These workforce reductions are likely to impact the study area as those who no longer have employment at Hillside move into other employment (possible outside the region, depending on the state of the market at the time), unemployment or retirement.

Figure 02 Workforce distribution during operation



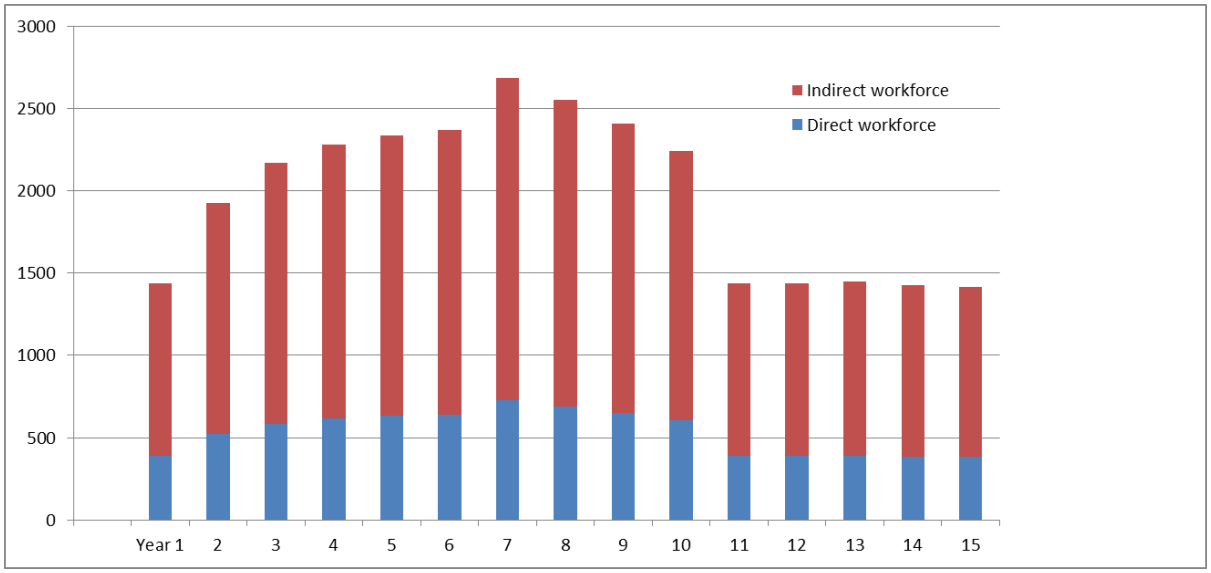
Indirect employment

In general, an indirect multiplier of 3-4 is used to estimate indirect employment in the Australian mining industry (ACIL Tasman 2009). The Minerals Council of Australia (2010) estimated that for every job created in mining, a further 3.2 jobs were generated indirectly in employment supporting mining. The Australian Bureau of Statistics (ABS 2011) similarly provides a multiplier of 3.0. Another recently established copper mine in South Australia used a multiplier of 2.2 (Enesar 2007). For the purposes of estimating the effect of the Hillside Project on indirect employment on the Yorke Peninsula, a mid-point multiplier of 2.7 has been used. This reflects the low unemployment in the region (which could be as low as 2.8% (DMC 2012)), the level of industry that exists in the region already and its proximity to Adelaide.

Using this multiplier, the Hillside Project would result in an additional 1,437 jobs on average over the life of the Project. Figure 03 shows the multiplier effect on indirect employment.

Because of the direct correlation between direct and indirect employment, the same reductions in employment at years 10 to 11 and at end-of-mine-life as described in Direct employment is true for indirect employment. Between years 10 and 11, indirect employment will reduce in the order of 44% (586 positions). At closure, positions related to the provision of goods and services that are dependent on the mine's operation will no longer be required.

Figure 03 Indirect employment

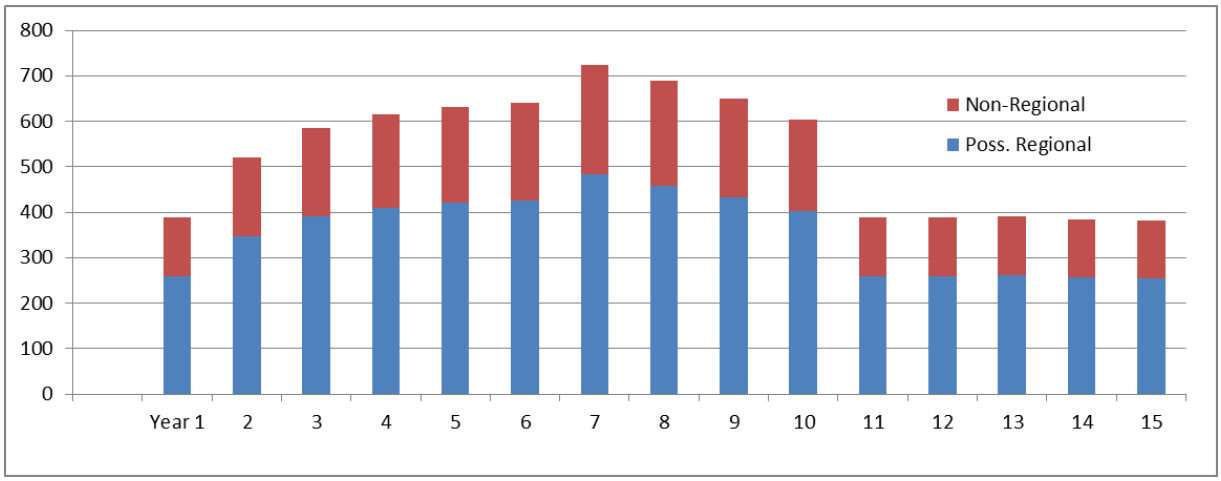


2.2.2 Increase in regional employment

Rex estimates that 33% of its future workforce will comprise people who are already working and living on the Yorke Peninsula; a further 33% will people who are presently living on the peninsula but working elsewhere, or who have some connection with the peninsula in the form of temporary or permanent accommodation, and the balance (33%) will comprise people who are employed from outside the region – they may commute via ferry from Adelaide or daily bus from Port Wakefield and/or be sourced from Adelaide, elsewhere in the State or from interstate.

Over time, the distinction between regional and non-regional employment will blur as people relocate to the region for employment at or associated with the Project. It is likely that former residents of the region who have moved away for work in the mining industry, or those that currently fly/drive -in-and-out of the region for work in mining, will look to return to the district, preferring to work at Hillside and reside in the region. This is important in understanding the impact of the Project on population in the region (refer Section 2.3 Local population). Figure 04 shows the potential workforce profile of regional vs non-regional workers.

Figure 04 Regional vs non-regional workers



2.2.3 Increase in regional competition for skilled labour

In 2011, Resources and Engineering Skills Alliance (RESA) prepared a workforce study for the resources sector on the Eyre Peninsula (RESA 2011). It researched the workforce needs of two existing resources operations and seven potential new mining operations. It determined that if all seven new mines proceeded, more than 2,200 ongoing direct jobs would be created in mining and processing in addition to at least a further 4,500 jobs in construction of mines and infrastructure. It noted the high level of staff turnover in mining operations, acknowledging that new job openings would substantially exceed the number of new jobs created and estimated that replacement demand over the next decade would exceed 5,000 positions. While the RESA study related to the Eyre Peninsula (not the Yorke Peninsula) it provides a good indication of the regional labour market pressures likely to affect the broader region, including the Yorke Peninsula. It noted a range of occupations likely to be of highest demand and which included accountants, electrical, mechanical, plan and mining engineers, geologists and metallurgists, technicians, trades, plant operators and truck drivers.

Given the low levels of unemployment in the regional study area, the increasing levels of industry over recent years and the number of significant projects being proposed in the region (including large wind farm developments), there will be increasing regional competition for skilled labour over the next decade.

It is anticipated that employees for the Hillside Project will be sourced primarily from existing positions (potentially to the detriment of other employers). Employees may also be sourced from the large pool of working-age people currently not engaged in the workforce (54.5% in the primary study area and 48.4% in the region)(DMC 2012), if they determine that the incentives to do so are worthwhile (for example, a tight regional labour market might result in increased wages and/ or improved workplace flexibility and conditions that may entice some of those people who are currently not working, into the workforce). It is also possible that a greater number of persons from outside the region will be recruited to the Project to fill non-specialist roles, thereby impacting the estimates provided above.

At particular risk, will be the prevalent industries in the region that rely on seasonal and casual employment (such as agriculture and tourism) and those occupations identified by the RESA study above. Competing with ongoing and potentially higher-paying employment at the at the Hillside Project, employers requiring seasonal and casual employees may be required to fill those roles from people from outside the region where previously they have been able to recruit a workforce in closer proximity. The may result in greater transience in the population during peak employment times. Additional population attracted by increased employment opportunities may partially offset this potential seasonal labour supply shortage.

Attracting skilled former residents back to the region will mitigate some of the impact of labour competition in the region.

The skills of spouses of workers from outside the region who relocate to the peninsula may increase the overall skills base of the region and could benefit the local population if those skills address other shortages (such as in the areas of health and education).

2.3 Local population

2.3.1 Increase in local population

The Project will directly employ an average of 532 people over the estimated 15+ years of its mine life. Of those, it is expected that about one-third or workers (~177 people) are likely to be employed from outside the region (ie, further away than daily driving distance). This figure may be higher depending on the availability of skilled labour in the region. Given the Project's estimated long life, a percentage of operational workers are expected to relocate to the region. Those that do not relocate will occupy temporary accommodation in the region for the duration of their rosters (commuting then back to their point of origin). An assumption of 50% of the non-resident workforce relocating to the region would result in an increase in the regional population of 88 persons directly employed at Hillside. The figure of 50% has been assumed based on the favourable amenity of the region and its distance from other larger population centers (ie, Adelaide) making it unlikely that the majority of people would choose to commute for any significant length of time. Given approximately half of Australia's population of persons aged 15 and over are married; half again have children; and the average number of children per family is 1.9, a population multiplier of 1 has been applied to half the direct workers (to estimate the additional population of half the workers bringing a spouse) and a further multiplier of 1.9 (children) has been applied to half of the assumed married couples. This results in a total population increase of 173 people as a result of direct employment at the Project (including workers and some spouses and children).

Applying the same rationale to indirect employment (ie, 33% of indirect employment being filled from workers from outside the region (474 people); assuming 50% of those relocate to the region (237 people); assuming half are married and half again have children at rate of 1.9 per family) an additional 468 persons would be added to the regional population from indirect employment.

Combining the population multipliers from both direct and indirect employment would result in a total increase in population in the region of 642 people or 2.1% (based on ABS 2011 population figures for Goyder SED of 30,800)(DMC 2012).

2.3.2 Increase in volunteering and community participation

Volunteering is undertaken by almost a quarter of the population aged 15 and over in the regional study area (DMC 2012). An increase in the permanent population in the region is likely to mean a commensurate boost in the number of volunteers, albeit is not likely to impact the overall regional volunteering effort (ie, greater population will result in greater number of people volunteering, but the proportion is likely to remain the same at about 25% of the total population).

Other community groups, including sporting groups and mothers associations, will similarly likely benefit from increased participation from an increased population.

2.3.3 Effect on community cohesion

The number of direct and indirect workers that are employed from outside the region is likely to correlate directly to the effect of the Project on community cohesion in the short-term. This is simply the result of the increased population and the time it will take for new and existing residents to become familiar with communities' dynamics. For the BHP Billiton Olympic Dam Expansion, a review of social impacts and lessons from other mining developments was undertaken (BHP 2009). The review analysed the social impacts of about 20 other mining

developments from Australia and overseas from existing literature and discussions with research and mining companies. Of the mining development where such could be ascertained, it found mining developments had negative impacts on community cohesion in four of the case studies assessed. In one, it reported community cohesion increased.

If, as assumed, the majority of positions are filled by existing residents of the region, the effect on community cohesion is expected to be less. However, if greater numbers of “outsiders” relocate to the region, or if lesser people choose to relocate (and merely commute to the region for their rosters), then residents (existing and new) may feel less connected with each other and the communities in which they live. Noted already, this decrease of community cohesion may be exacerbated if competition for skilled labour results in an increase of “outsiders” being employed for the region’s significant amount of seasonal and casual work. Many communities on the peninsula are already exposed to the regular in-coming of retirees and tourists and have demonstrated that they are able to adjust well to newcomers, thus decreasing the potential impact of newcomers on community cohesion.

At the time of writing, the Hillside Project and Rex staff had become familiar within the local community and Rex was generally seen as a contributor to and supporter of community initiatives.

2.4 Health and wellbeing

The potential community health implications resulting from mining activities – such as those resulting from air, water and land emissions and the use and transport of hazardous materials – are regulated and controlled through approved management plans. Non-conformances require regulatory reporting. The potential impacts of the Project on air, water, land and hazardous materials are addressed in the environmental section of the Mining Lease Proposal (Rex 2013).

The three potential community health and wellbeing impacts addressed in this chapter are i) road safety from increased traffic associated with the Project, ii) increased mental health issues associated with the presence of the Project and iii) changes in lifestyle affecting health.

Issues relating to access to and quality of health services in an environment of population influx are addressed in Section 2.5 Community services and facilities.

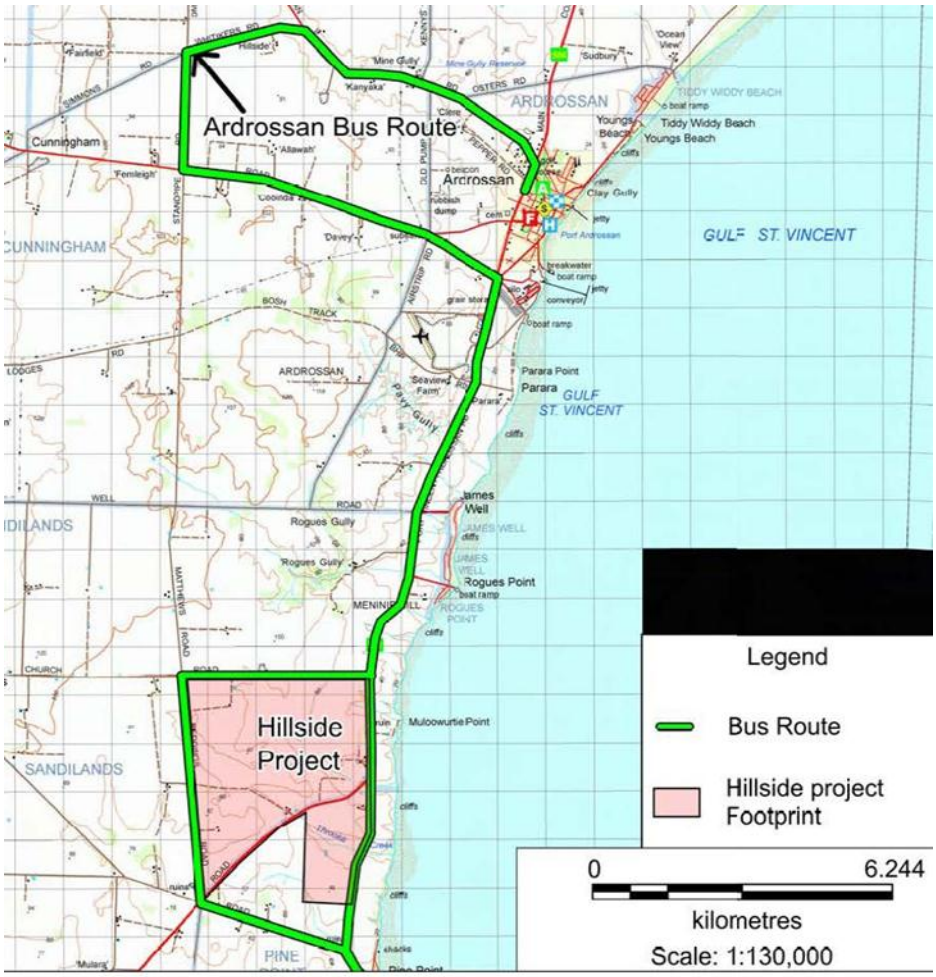
2.4.1 Road safety from increased traffic associated with the Project

The increased traffic implications of the Project are described in Section 2.6 Infrastructure. With greater movement of vehicles to and from the Project site and around the region, particularly in towns, from mine activities and increased population, there is a commensurate increase in risk of traffic accidents.

Increased traffic is addressed in Section 2.6 Infrastructure. Figure 05, Ardrossan school bus route, shows that the bus route for the Ardrossan area school travels south along the Yorke and St Vincent highways past the Hillside Project to Pine Point, along the Pine Point Road onto Redding Road, then east along Sandy Church Road, back onto the Yorke Highway and returning to Ardrossan.

Given the increased traffic projections resulting from the Project, particular safety management will be required to ensure safety of students embarking and disembarking the bus.

Figure 05 Ardrossan school bus route



2.4.2 Increased mental health issues associated with the presence of the Project

In some cases of mining development, some members of host communities oppose such development. Prolonged focus on the perceived or actual negative aspects of the Hillside Project and/or perceived loss of amenity or reduction in environmental or social value may contribute to deterioration in mental health.

2.4.3 Changes in lifestyle affecting health

Depending on working hours required by the Project, some workers may be deterred from undertaking daily exercise and/or generally maintaining healthy lifestyles. Conversely, increased wealth in the region may result in improved lifestyles for individuals and families.

A potentially positive impact on health may be an increase in health services and facilities provided by Government or non-government agencies triggered by increased population / demand. Similarly, Rex may invest in health initiatives as part of its community investment program. Further, the associated population that may relocate to the region may include additional health professionals.

2.5 Community services and facilities

The Project itself will have little negative impact on community services and facilities. On the contrary, the addition of workers to support community initiatives, sporting events and volunteering, as well as donations likely to be provided by Rex to certain causes, will likely provided a valuable boost to community services and facilities in the region.

The site-related first aid health needs of workers will be met by on-site first aid facilities. Other health needs of workers will be met by existing services. The mine's emergency response team will share resources, training and equipment with community emergency services, providing an overall boost to emergency response capability in the region. In the event however, of a major incident at the mine, additional emergency and health services may be required. Conversely, if a major non-mine related incident occurred in the region, the mine resources would likely be offered to assist. A helipad may be constructed on-site, in addition to the helipad that exists in Ardrossan, to be used in the event urgent medevac is required.

The increased population in the region from direct and indirect employment at the Project, however, is where impact on community services and facilities is likely to occur. In this case however, possible the result of a declining population in some communities over past years, the region is well serviced and relatively well positioned to accommodate population increases (DMC 2012).

2.5.1 Effect of increased population on health services

In the area of health, the region generally is well serviced with at least 10 health centers peppered across the region and seven public and private hospitals providing a range of accident and emergency, acute inpatient, elective surgery, maternal and birthing, community health, aged care and various associated and clinical support services to their communities. No obstetrics services exist in Ardrossan; this is potentially one of the services that will come under increased demand if a portion of newcomers consist of young couples starting or having families (DMC 2012).

There are some existing access difficulties to local and metropolitan health facilities due to limited public and community transport (DMC 2012), which will be exacerbated with increased population unless services are increased.

2.5.2 Effect of increased population on education and childcare

Education services and facilities are generally underutilised across the region, with more than 100 vacancies across all classes at the Ardrossan Area School alone at the time the socio-economic baseline report was compiled (DMC 2012). Additional studies could be accommodated with larger class sizes (up to 25 per class from the present 20-student capacity). Additional teachers would be required to accommodate increased class numbers at the school. Outside Ardrossan, there are a further 13 primary schools across the region, four area schools (R-12), two secondary schools, two private primary schools, two private secondary colleges, an Aboriginal school, a special education unit for disabled students and two support units for home schooling. Most of these services reported some vacancies (DMC 2012).

At the time the socio-economic baseline report was compiled the Ardrossan Community Kindergarten had capacity for 30 preschool children with vacancies for five children in one session and one child in another session (DMC 2012). Availability of child care services is

generally problematic in resource-boom towns and, despite the six vacancies reported at one kindergarten in the region in August 2012 (DMC 2012), is likely to be one of the services that will come under increased demand if a portion of newcomers consist of young couples with young children or having families.

2.5.3 Effect of increased population on police and emergency services

The crime rate in the DCYP is markedly lower than the crime rate for the Yorke and Mid North region and crimes are largely against property, driving offences or crimes against good order (drug offences) (DMC 2012).

The crime rate reportedly spiked over the summer months with greater population/visitation numbers in the area (DMC 2012).

The region contained 29 police stations (Mid North and Yorke Police Local Service Area), yet the police station at Ardrossan was manned by only two police officers (thought to be insufficient (DMC 2012)). When officers were not present, inquiries were redirected to the Kadina Police Station, located approximately 60kms away by road.

Increased population in the region, potential greater transience (refer Section 2.2 Employment) and increased traffic are likely to require greater police presence in the area, particularly when the population is further inflated with summer visitors.

At the time the socio-economic baseline report was written, the only professional ambulance service in the region was located at Port Pirie; the regional study area was covered by volunteers, including an SA Ambulance brigade based at Ardrossan (DMC 2012). General health issues of a larger population and increased traffic on local roads may increase the need for ambulance services. Additional population many also increase the volunteer base for ambulance services.

The region is well equipped with 16 country firefighting services including services based at Ardrossan (DMC 2012). As with other emergencies, if a major fire occurred on the Project site, the services of the CFA would likely be required and conversely, the mine rescue team would likely be offered to assist the CFA in the event of a non-mine related major fire. Again, additional population may increase the volunteer base for firefighting services.

2.5.4 Effect of increased population on retail and commercial services

Where practical, Rex will procure goods and services for the Hillside Project from within the region in order to maximise the local economic benefit of the Project. Clearly specialised equipment will be sourced from elsewhere (possibly even internationally), but the effect of smaller-scale procurement locally cannot be understated.

A larger population in the area will provide additional demand for a spectrum of goods and services, much of which the day-to-day requirements of households are available for purchase in the region. This is likely to strengthen the viability of existing goods and services and may even create the environment for the introduction of new goods and service providers, increasing the product options available and possibly even the competitiveness of prices for regional residents.

2.5.5 Effect of increased population on cultural and leisure facilities

The regional is well serviced with cultural and leisure facilities. A wide range of sporting clubs

exist in the region providing a varied range of recreational pursuits in addition to the opportunities available from the coastline surrounding the peninsula. Many clubs are actively seeking new members to maintain their viability. Similarly, thriving artist communities exist throughout the region and local artist groups hold regular exhibitions, and participate in festivals such as SALA (South Australian Living Artists) Festival and Flinders Ranges: a brush with art Festival. The region is home to many galleries and arts- and craft-related businesses (DMC 2012).

The increase in population in the region is likely to result in greater numbers of people accessing leisure facilities (potentially increasing their viability and/or increasing investment back into the quality of such facilities), and participating in sporting teams and events or their coordination and administration.

The increase in population in the region is likely to result in greater numbers of people interested in cultural facilities and activities, thereby enriching the cultural fabric of communities, potentially adding to the attractiveness of living in or visiting the region.

Further, cultural and leisure facilities and initiatives may benefit from time-to-time, or for particular projects, from sponsorship from Rex, its workers and/or the broader population.

2.6 Infrastructure

2.6.1 Effect of increased population and mine activities on transport infrastructure (roads)

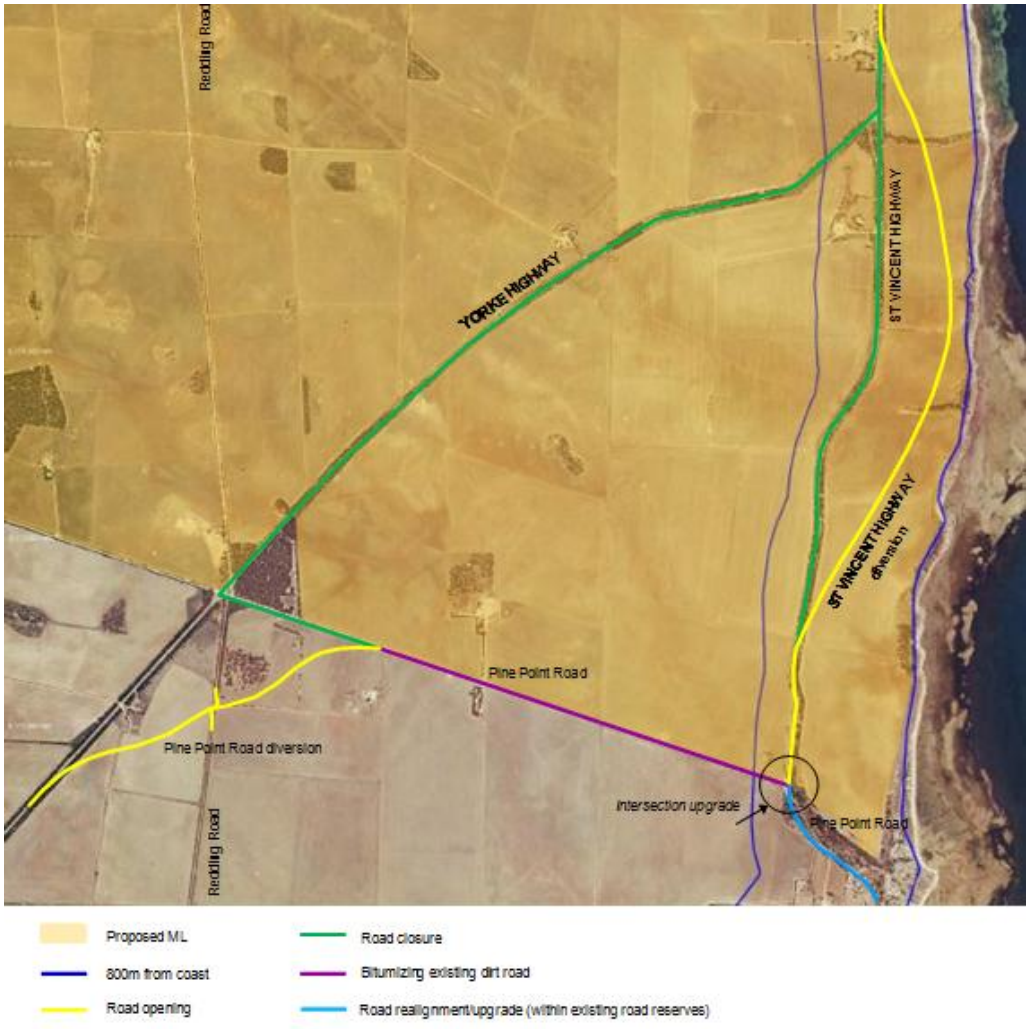
Improved safety from road amendments

The region and project area are well supported via good quality sealed national and regional highway systems, making road travel relatively easy and safe. Given the condition of the road network on the peninsula, it is likely it has the capacity to accommodate increased light vehicle traffic around the region from increased population resulting from the Project.

For mine traffic, a section of the Yorke Highway will be realigned outside the mine blast exclusion zone. The realignment will shift the road closer to the coast. The alignment route integrates the upgrade of the Pine Point Road junction with the main alignment and addresses sight restriction issues. Its proximity to the coast is expected to provide enhanced coastal views which may benefit tourism. Significant intersection upgrades will also improve safety at these intersections and additional lanes will improve traffic flow.

In addition, the section of the Yorke Highway, which currently runs through the mine site, will be closed and an alternative route established via an upgrade of Pine Point Road. Construction of a new section of road of equivalent standard to the existing road to facilitate vehicular reentry to the existing York Highway will result in a slightly longer travel distance for road users. The upgrade of the Pine Point road may cause some temporary disruption to traffic currently using that section of road. Other sections of the road will remain open until new sections are completed and hence no traffic disruptions are anticipated. Figure 06, Proposed road works, shows, in green, the section of the Yorke Highway that will be closed and, in yellow and purple, the rerouting of the St Vincent and Yorke highways.

Figure 06 Proposed road works



Increased mine-related traffic

A slurry pipeline system will transport iron and copper concentrate from the mine to the port site, thereby avoiding the need to transport concentrate along the Yorke Highway via trucks. As a result, increased traffic from the Project during operation will consist primarily of i) heavy vehicles transporting consumables and equipment to and from the Project site, ii) buses transporting workers from designated locations within the region to the mine and port sites and iii) light vehicles transporting workers to and from the mine and port sites and within the region.

Actual numbers of heavy vehicles, buses and light vehicles were unknown at the time of writing and the following assumptions have been made on estimated quantities of consumables and equipment required to supply and mine. For busses and light vehicles, assumptions have been made on workforce numbers and role types.

It is assumed that heavy vehicles will primarily travel to and from the mine and port sites along the Yorke Highway, to the upgraded Sandy Church Road intersection, entering the mine site off Sandy Church Road. During operations, it is estimated that up to 10 heavy vehicles will access the mine site daily; that is, a total of approximately 20 vehicle movements to and from the mine

site daily. To the port site, it is estimated that up to three heavy vehicles will access the mine site daily; that is, a total of approximately six vehicle movements to and from the port site daily.

Buses used to transport employees to the site will travel primarily along the Yorke Highway and St Vincent Highway, entering the site at the same location as heavy vehicles. The use of buses to transport workers to and from the mine and port sites aims to reduce the amount of light vehicle traffic that would otherwise be generated if workers drove their own vehicles to the sites. It is expected however, that a small number of workers will, for various reasons, travel to and from the port and mine site in light vehicles. Light vehicles, depending on their origin, will likely travel primarily along the Yorke Highway and St Vincent Highway. Table 04, Estimated vehicle movements, outlines the estimated total vehicle movements expected to and from the port and mine site each day.

Table 04 Estimated vehicle movements

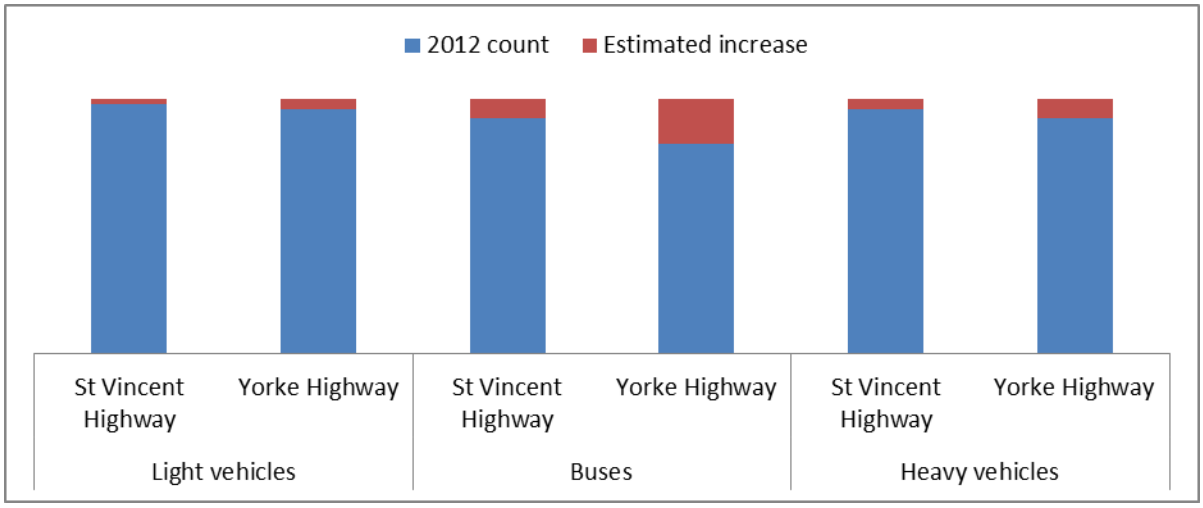
Site	**Vehicle movements**		
	Light vehicles	Buses	Heavy vehicles
Port site	20	4	6
Mine site	160	20	20

The Yorke and St Vincent Highways are major linking roads along the peninsula, and are a primary connection between a number of townships and grain storage and export facilities. They are both major tourist conduits on the peninsula. Consequently both roads currently support significant volumes of light and heavy vehicle traffic, particularly during harvest and peak tourist times (Rex 2013b).

Rex (2013b) conducted a traffic survey of roads in the Project vicinity, counting traffic during peak tourism and harvest times. Figure 07 Estimated mine-related traffic increases, shows the highest (worst case) traffic counts on the St Vincent Highway and Yorke Highway during peak tourism or harvest times (that is, the higher count from either peak tourism or harvest times is shown). The figure shows that light vehicle increases are estimated at less than 5% on both the St Vincent and Yorke highways; medium vehicle traffic will increase by about 8% and 21% on the St Vincent and Yorke highways respectively; and that heavy vehicle traffic will increase by about 4% and 11% respectively. Given the actual vehicle numbers were not known and are assumed only, the estimated project increase percentages should be used as indicative only.

These indicative estimated project increases in traffic on the St Vincent and Yorke highways show that traffic increases directly associated with the Project are not significant, except for the effect of buses on the Yorke Highway. For the purposes of this exercise, all project buses have been assumed to travel along the Yorke Highway, albeit that some will only travel on the St Vincent Highway before joining the Yorke Highway to access the mine entrance.

Figure 07 Estimated mine-related traffic increases



During construction there will be additional traffic to and from site. In particular there will be an increase in over-sized traffic. Oversize traffic movement will require management to reduce traffic flow impacts. Specific construction traffic management plans will be developed.

Increased non-mine-related traffic

Traffic not directly associated with mine is expected to increase on a section of Pine Point Road once it becomes the rerouted Yorke Highway. Estimates suggest traffic will increase more than 25-fold (Rex 2013b). At peak traffic periods (during holidays for light and medium vehicles and harvest for heavy vehicles) light vehicle traffic is expected to increase 30-fold over current levels, medium vehicle traffic will double, and heavy traffic will increase 23-fold. This will impact residents living along, and users of, this section of road. The upgrade of the road and intersections will improve road safety and have minimal impact on travel time.

Increase in local traffic independent of the direct mine traffic will be associated with increased population in and around towns in the region. The ABS (2011) estimated that across Australia, there were 1.7 cars per dwelling. With the additional population, estimated to require 317 accommodation units in the region (refer Section 2.7 Housing and accommodation), it can be assumed that almost 540 additional light vehicles will be used in the region as a direct and indirect result of the Project. Usage rates and patterns are unpredictable. With a lack of public transport in the region, this additional population will inevitably move around the region using motor vehicles, bicycles and on foot, adding additional vehicular and pedestrian traffic.

Residents of coastal settlements of James Well, Rouges Point and Pine Point who use the Yorke and St Vincent Highways to access their properties, and particularly those that use the section of the Pine Pont Road that will become the rerouted Yorke Highway, are likely to notice increased traffic on the Yorke Highway in the section between Ardrossan and the Project site.

Noise assessments of the road amendments were conducted by AECOM (2012) which found that noise criteria would not be exceeded at identified noise-sensitive receivers. Two residences either side of the Pine Point Road were assessed. AECOM (2012) predicted that daytime noise levels at those residences were predicted to increase by 5 and 10 dB(A) respectively. However, both the day- and night-time noise levels were predicted to remain at least 5 dB(A) below the Road Traffic Noise Guidelines criteria.

2.6.2 Effect of increased population and mine activities on power and water

Power to the Yorke Peninsula is supplied by ElectraNet and supplemented by wind power. Wind farm expansion/approvals are being considered and two gas turbine power stations, located just outside the regional study area, generate electricity that supplies some of the region's requirements.

Options for the power for the Project include will be supplied primarily from the grid with some upgrading in transmission. The Project will need to effectively manage its usage so as to avoid overloading the system. Any linking with the existing grid will be on the basis that if power supply is nearing overload, the Hillside Project power supply will be reduced. Consequently voltage control systems, coordination with wind farm generators and a 275kV injection into the Project is expected to alleviate issues of system overload.

Further, additional population attracted to the region for direct or indirect employment as a result of the Project, will add demand to domestic power and water supplies, particularly if significant new housing construction occurs. In this case, it is likely that planned power supply upgrades would alleviate these problems.

An upgrade of the power supply to the Hummocks Sub-station is planned for 2018. The Hillside Project will act as a stimulus to upgrade power supply to the Yorke Peninsula sooner.

Water supply for the Project will be derived from a number of sources including mine dewatering, sea water (both used for process water) and fresh water used for the filtration and wash plant located at the port and potable water supply for the mine site. At the time of writing, the Hillside Project expects to use approximately 410t/h of water from mine dewatering, 170t/h seawater and 53t/h potable water from the SA Water network to run all aspects of the operation. In addition, increased population will consume water from the region's domestic supplies. Rex has reached an agreement with SA Water for the development of water infrastructure to meet the needs of both the Hillside Project and provide for additional water capacity for regional development. Rex will contribute up to $4.4 million towards water infrastructure in 2013 and $4.4 million in 2014.

According to the DCYP, Ardrossan was well equipped to accommodate residential development with adequate sewerage, water and power systems in place (DMC 2012).

2.6.3 Effect of increased population and mine activities on waste management

Domestic waste from the Project will be disposed at a local council-regulated landfill site. This, and domestic waste produced from increased population in the region, will increase waste to landfill and the demand for waste removal and management services.

Rex will recycle bottles and cans, plastics (HDPE) and metal and arrange for their removal by private contractors. Sewerage from the Project will be collected and disposed by Rex, which will construct its own system incorporating a treatment plant.

2.6.4 Improvements to infrastructure (ferry)

The Hillside Project may provide impetus for the improvement in other infrastructure in the region. In particular, Sea Link is investigating the feasibility of a high-speed ferry service from outer harbor in Adelaide to either Port Vincent or Ardrossan to provide a service for workers to travel from Adelaide to Hillside on a daily basis. The service may also be available for public use.

2.7 Housing and accommodation

Rex Minerals does not at this stage plan to provide permanent accommodation for workers at Hillside but rather to source accommodation within local communities. Rex will, however, relocate an existing camp currently owned by the contract drilling company closer to the Hillside Project and upgrade it to provide temporary accommodation for approximately 120 people. This camp will house visitors and those requiring overnight accommodation and for shut down crews thus relieving potential pressure on tourism accommodation. It may also provide short-term accommodation for workers while they secure alternate accommodation. Accommodation facilities for workers during the construction phase will be a combination of temporary camp facilities located at the Hillside Project site and local accommodation.

At the time of writing, the Hillside Community Consultative Group was developing an accommodation strategy to support its preference of accommodating all newcomers within existing communities, rather than in a mining camp. The opportunity to revitalize the many small communities on the peninsula (many which were suffering from declining populations (DMC 2012) and retaining the social and economic benefits of a residential mining (and associated) workforce is being considered in this strategy.

2.7.1 Increased population requirements for housing and accommodation

Using the population assumptions from Section 2.3 Local Population, the assumed 50% of direct and indirect workers from outside the region who choose to relocate to the region, means that a total of 325 people (88 direct employees and 237 indirect workers), will need permanent accommodation in the region. Some of these people will bring spouses and/or children and some will not, as estimated above, but this is somewhat irrelevant to the actual number of accommodation units[1] that will be required. It can be assumed that a proportion of people will share accommodation. The Australian average for 'group households' is 4.1% (ABS 2010). Assuming the same is true of household structures generated from direct and indirect employment as a result of Hillside, 13 people (of the total of 325 requiring permanent accommodation) will share housing, at an Australian average rate of 2.6 persons per house (requiring approximately five accommodation units). **Thus, a total 317 individual permanent accommodation units (houses, flats, etc.) will be required to house the increased population.** This represents a 'worst case' situation, given that the only 'sharing' of accommodation provided for is share housing (ie, unrelated persons sharing a house or unit). It may be the case that husbands and wives, or parents and siblings or two or more siblings are direct or indirect workers and share accommodation (that is, they have been counted as each requiring a separate accommodation unit, when in fact they share an accommodation unit).It would be unlikely that more than 10% of the non-local, direct and indirect workforce who will relocate to the area would be in this situation meaning any variance in the estimated total number of accommodation units would be less than 32 units (reducing the overall need to

[1] An accommodation 'unit' in this instance refers to a form of accommodation, be it a house, unit, flat or other type, required by an individual, couple or family.

approximately 285 accommodation units). The working for this assumption is shown in Table 05 Housing and accommodation needs.

Table 05 Housing and accommodation needs

		Direct employment	**Indirect employment** (direct employment x 3.2 multiplier)
A	Total	532	1,437
B	Resident	357	963
C	Non-resident	176	474
D	50% non-resident expected to relocate	88	237
E	Total individuals expected to relocate	325	
F	Total individuals expected to share	13	
G	Accommodation units required for individuals who share	13 persons living together at a rate of 2.6 persons per accommodation unit = 5 units	
H	Total accommodation units required	E –F+G= **317**	
I	Conservative estimate deducting 10% for related individuals	285	

Ardrossan is the largest, fully serviced town in closest proximity to the Project site. With its proximity, infrastructure, services, apparent housing availability and pleasant environment, it can be assumed that the majority of new residents to the region will settle there. However, within daily drivable distance are a range of towns and settlements of varying sizes and degrees of servicing, which each offer their own natural attractions for new residents. The availability of housing, services (primarily health and education) and facilities, and quality of road infrastructure providing access to services and infrastructure will determine where newcomers to the region choose to reside. Outside Ardrossan, health and education services are available in Maitland, Minlaton, Moonta, Wallaroo and Yorketown, making these centres likely for consideration by newcomers. Various holiday settlements that exist to the north and south of Ardrossan and on the western side of the peninsula lack some services therefore are less likely to attract new residents. However, those within close proximity to the towns listed above may also be considered pending availability of suitable accommodation.

The 33% of direct and indirect workers from outside the region who choose not to relocate to the region but rather to commute for each roster, means that 88 direct employees and 237 indirect workers (a total of 325 people) may need temporary accommodation in the region for the duration of their rosters or work contracts.

2.7.2 Reduction in availability of housing and accommodation

The number of unoccupied dwellings in the primary study area is almost five times the average for both the State and Nation, and is likely indicative of the holiday nature of some of the communities within postcode 5571 (DMC 2012). A large number of unoccupied dwellings (7,482) also exist across the regional study area (DMC 2012).

According to the District Council of Yorke Peninsula (DMC 2012), land availability in the primary study area is not constrained for future development and that there were more than 200

residential lots available at Ardrossan alone at the time of writing. This was in addition to other subdivisions in various stages of planning and approval in Port Vincent and James Well, as well as rezoning occurring around Maitland, Minlaton and Woorooka that aimed to expand the existing town boundaries.

According to the DCYP, Ardrossan was well equipped to accommodate residential development with adequate sewerage, water and power systems in place.

The only likely constraint to rapid development in the primary study area, according to the DCYP would be the DCYP's capacity to cope with significant additional planning and approval workload.

At the time of writing, there were only 21 properties listed for rent on the Yorke Peninsula and only four in postcode 5571, according to popular website Domain.com (accessed 7 January 2013). Used only as an indication, the scarce number of listed rental properties suggests the rental market on Yorke Peninsula is reasonably tight, offering only limited options for newcomers wanting to rent in the area.

Irrespective of the availability of existing accommodation and land for development, the requirement for a region to make available between 285 to 317 accommodation units in a relatively short timeframe (peak workforce requirements are at year seven), is likely to be difficult to achieve in the short-term. This could potentially have the effect of:

- Preventing eager newcomers from relocating in the short term;
- Driving up housing and accommodation costs as demand outstrips supply, particularly in the short term and during peak tourism periods.
- Potentially making accommodation unaffordable for low-income earners in towns preferred by potentially higher-income-earning newcomers.

DMC (2012) identified a reasonable number of temporary accommodation venues available in the study area but noted that availability in peak season was limited and/or non-existent in some locations at some times of the year.

Use of temporary accommodation by some direct and indirect workers of the Project will increase occupancy and demand for temporary (hotels, motels and caravan parks) and short-term rental accommodation, potentially increasing revenue for investors, developers and temporary accommodation owners in the region. However, it may also have the effect of making accommodation unavailable, particularly at certain times of the year, for visitors to the area for other reasons (particularly tourism and during harvesting).

2.7.3 Reduction in housing and accommodation affordability

Increased demand for housing to buy and rent, and for temporary accommodation will have the effect of increasing cost and reducing affordability, particularly for lower-income earners. As described above this may have the effect of preventing eager newcomers from relocating in the short term; deterring visitors who wish to come for the region for other reasons; and potentially making accommodation less affordable for low-income earners, who may then relocate to towns less preferred by newcomers (those settlements where populations are declining and/or are not well serviced or located further away from infrastructure and services).

Increased demand for housing and accommodation will make markets more competitive and potentially increase revenue for investors, developers and temporary accommodation owners in the region.

2.7.4 Reduction in housing and accommodation quality/standards

If demand for accommodation becomes high and subsequent costs increase, as they likely will, there is potential for the use of lesser quality housing and accommodation by, particularly, temporary workers and visitors to the region and low-income earners. Buildings that may otherwise not be consideration for habitation (those which have become run-down, garages, outhouses and caravans) may be occupied in the absence of other available, affordable accommodation, with associated health, wellbeing, safety and security implications for occupants.

2.8 Economy

The Hillside Project will provide a direct economic contribution to the Yorke Peninsula, the State of South Australia and the nation. Dollar values herein are stated in AUD. Project production and financial data are taken from the Hillside Project pre-feasibility study report.

The Project intends to produce 70,000tpa of copper, 50,000ozpa of gold and 1.2mtpa of iron ore, with a pre-tax annual operating cash flow of $240 million (base case). This equates to 1.05mt of copper and 750,000oz of gold and 18mt iron ore over the mine's life, and more than $3.6 billion pre-tax operating cash flow.

Total pre-production capital estimated for the Hillside Project is approximately $900 million, comprising approximately $100 million in pre-strip and mining infrastructure, $680 million in process plan and surface infrastructure, $120 million in iron ore extensions and a $90 million contingency. Operating costs are estimated in the order of $530 million per annum, or almost $8 billion over the life of the Project.

2.8.1 Effect on economy

Gross regional and State product

The Project will contribute to growth in gross regional and State product as a result of:

- Increased mining activity in South Australia with the mining and processing of gold, copper and iron ore.
- Increased net exports of copper concentrate, and iron ore.
- Increased employment in South Australia.
- Increased wage rates in South Australia.
- Higher levels of household income and consumption in South Australia (resulting in increased living standards).
- Increased investment in South Australia (greater than the direct investment in the construction and operation of the Project).

Economic stimulus is expected to be greatest during construction of the Project but will be ongoing for the life of the mine. A direct contribution to gross State product of approximately $11 billion is estimated.

Employment

The Project will employ approximately 532 people, on average, over the life of the mine (refer Section 2.2 Employment) for a total estimated workforce cost of more than $1.3 billion.

The effect of the Project on indirect employment is outlined in Section 2.2 Employment and estimated at approximately 1,437 additional jobs.

Average wages in South Australia are $60,559 gross per annum (ABS 2011). The average wage of a worker at the Hillside Project is estimated at approximately $100,000 gross per annum. This is a crude average given it makes no distinction between semi-skilled, skilled and technical roles, nor gender wage differences. Nevertheless, it indicates that the Hillside Project is likely to increase wage rates in South Australia and the region.

Increase in employment and wages from the Project will stimulate demand for other goods and services resulting in growth in other industries. Increased demand for goods and services will prompt further investment and profitability in other industries.

Income expenditure

Given the residential nature of the Hillside Project (refer assumptions in Section 2.2 Employment), it can be assumed that workers will spend part of their incomes on local goods including food, entertainment, accommodation, recreation, transport and services, driving growth in other industries, as described above.

Australian households spent the following proportions of their available budgets on the items specified in 2009-10 (RBA 2011): Food – 17%; alcohol and tobacco – 4%; housing – 24%; clothing and footwear – 6%; durables – 14%; essential services – 13%; discretionary services (recreation and pets) – 12%; transport and motor vehicles – 10%.

Spending on food, alcohol and tobacco, housing, transport and a portion of transport and motor vehicles and discretionary services is likely to occur in the region, if not the State. It can therefore be assumed that up to 67% of residential workers' incomes will be spent in the region or State, totaling in the order of $290 million over the life of the Project. A smaller portion of non-resident workers' incomes will also be spent in the region and/or State.

There is also a flow-on effect (multiplier) that suggests that for every $1 spent in the region by a mine worker, further economic impact is generated in the order of 40 to 90 cents depending on what that $1 is spent on (for example, education and training generates an additional 38 cents, retail an additional 81 cents and tourism an additional 92 cents on every $1 spent in other parts of the economy)(TRA 2012). This amounts to an additional economic impact in the order of $120 million to $270 million in the region over the life of the mine.

Regional expenditure on goods and services

A portion of the pre-production capital estimate of $900 million and ongoing annual operating costs in the order of $450 million will be expended in the region and South Australia. Maximising procurement of goods and services from within the region where possible will increase the portion of expenditure within the region.

Government revenue

The Hillside Project will contribute to significant additional government revenue at local, State and national levels.

Payroll tax in South Australia was set at a rate of 4.95% for the period 2012-2013 after a tax-free threshold of $600,000. Based on total estimated workforce costs, the Project is expected to pay in the order of $65 million in payroll tax to the South Australia Government over the life of the mine.

Total company taxes from the Project are expected to be in the order of $900 million, depending on production rates and product prices over the life of the mine.

Royalty revenue from the Project is expected to be in the order of $500 million, depending on production rates and product prices over the life of the mine.

The Project will increase GST revenue collected from South Australia.

Increases in residential development and land values in the region will result in increased rate revenue for local councils, among other potential revenue increases likely to occur.

Industry diversification

The Project will continue the diversification of industry occurring on the Yorke Peninsula and the economic base of the region.

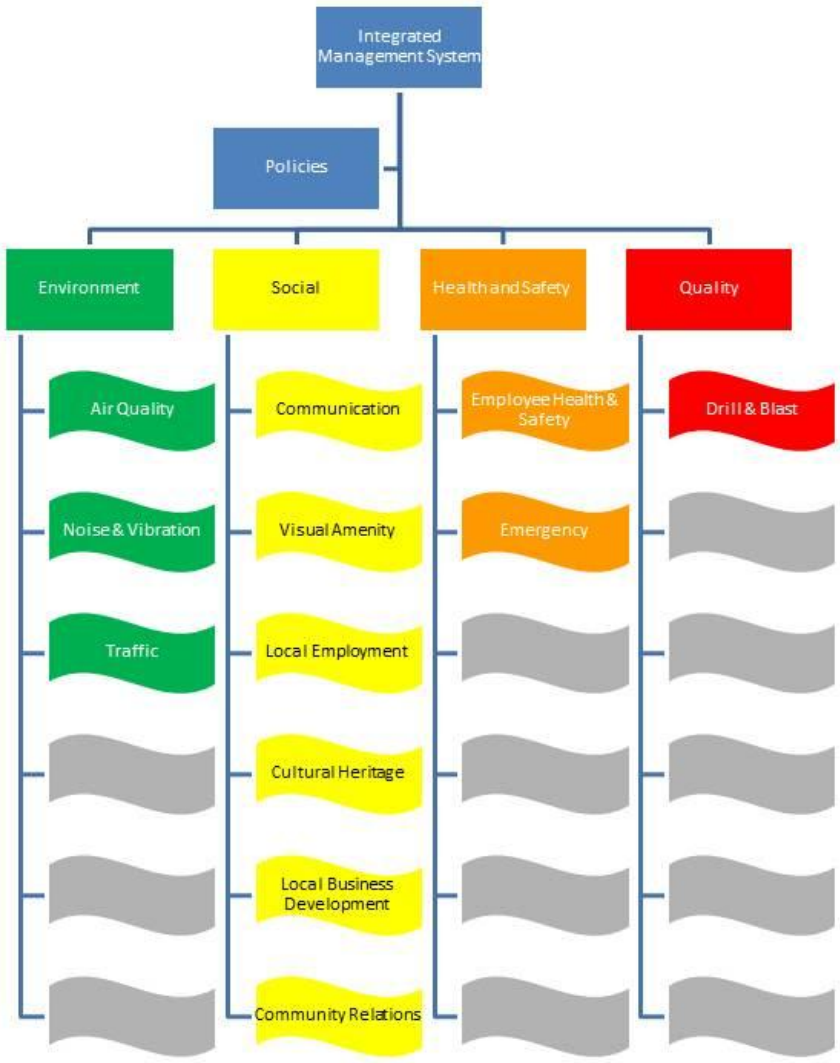
3 Management strategies

3.1 Integrated Management System

Social impacts (negative and positive) will be managed through Rex's Integrated Management System (IMS) which controls Rex's environmental, social, health and safety and quality performance.

An illustration of Rex's IMS is shown at Figure 08. Only the components referred to herein are included in the illustration. The grey boxes indicate various other components of the IMS that are not referred to herein. Like the environmental, health and safety and quality components of the IMS, the social management component contains standards, management plans, standard operating procedures and instructions that ensure Rex appropriately manages its social impacts and opportunities. In some instances, potential social impacts are managed by management plans contained within the environmental, health and safety and quality components of the IMS. Section 3 herein outlines how each of the impacts identified in the SIA will be managed by a component of the IMS.

Figure 08 Integrated Management System



3.2 Social Management Plans

Section 3.3 Impact Management outlines the management plan(s) that will be used by Rex to manage each potential social impact identified in Section 2 Potential Impacts. Table 06, Social Management Plans, outlines the key aspects of each management plan within the Social component of Rex's IMS. It must be noted that the management plans were under development at the time of writing and will continue to evolve, particularly taking into consideration outcomes from community consultation.

Table 06 Social Management Plans

Communication Management Plan		**Visual Amenity Management Plan**	
Id	**Key aspect**	**Id**	**Key aspect**
C1	Stakeholder engagement program that facilitates good, two-way communication, and provides access to information of relevance and concern to landholders and the wider community on project developments.	V1	Strategies will include visual screening where necessary, minimising plant lighting and signage where there is no impact on safety, minimising night traffic to and from the site, and ensuring infrastructure blends with the natural landscape.
C2	Operating protocols to manage interactions between project workers and adjoining landholders and their properties, developed in consultation with landholders, incorporating as much as possible, specific actions and requirements considered important by landholders in minimizing inconvenience to them.	V2	Consultation with affected landholders and land users, and the Community Consultative Group on the development of the Visual Amenity Management Plan.
C3	System of advanced notification of major activities or disruptions that may affect landholders or the broader communities. Include advanced notice, nature of, reason for, duration and severity of the activity or disruption.		
C4	System for identifying, monitoring and responding to landholder and community concerns. Must be well-publicised, accessible and easy to use for landholders and the wider community.		
C5	Consultation with the Community Consultative Group on the development of the Communication Management Plan.		
Local Employment Management Plan		**Cultural Heritage Management Plan**	
Id	**Key aspect**	**Id**	**Key aspect**
E1	Procedures for the identification of potential workforce reductions and appropriate communication of such to the workforce and local communities.	H1	Finds protocol.
E2	Accommodation strategy outlining the residential workforce objectives and tactics to ensure accommodation preparedness.	H2	Procedures for identification and protection and/or salvage of heritage items.

Local Employment Management Plan cont.		Cultural Heritage Management Plan cont.	
Id	**Key aspect**	**Id**	**Key aspect**
E3	Strategies to minimise the potential impact of significant workforce reductions on local communities. Strategies might include: staggered reductions in workforce numbers over a period of time; gradual cessation of employment where possible (ie, reducing from full-time, to part-time ahead of total cessation of employment; voluntary reductions ahead of non-voluntary reductions.	H3	Training and awareness.
E4	Provision of outplacement and employee support services to assist employees to transition from employment at Hillside to employment elsewhere.	H4	Reporting protocol.
E5	Appropriate targets for employment of people with the relevant skills or experience from the Goyder SED region, that is considerate of both the desire to maximize the economic benefits of the Project without depleting the region of skilled workers in other industries / businesses.	H5	Consultation with Traditional Owners and the Community Consultative Group on the development of the Cultural Heritage Management Plan.
E6	Training and education programs that give preference to participation by people from the Goyder SED region, in order to maximise local employment and human capital development.		
E7	Appropriate targets for the employment of, and participation in training programs by, Traditional Owners and vulnerable people, where possible.		
E8	Training and education programs in order to maximize the 'pool' of skilled labour in the region for employment at the Project. Where appropriate, Rex will offer non-mine employees the opportunity to participate in training and education programs in order to increase the 'pool' of skilled labour available to other businesses/industries.		
E9	Policy of consistency with other regional employers in the setting of wages and conditions, such as flexible rosters to allow for agriculture seasonal peak times, for mine workers.		
E10	Consultation with the Community Consultative Group on the development of the Local Employment Management Plan.		
Local Business Development Plan		**Community Relations Management Plan**	
Id	**Key aspect**	**Id**	**Key aspect**
B1	Engage with agencies (such as Regional Development Authority), local government and other employers to plan, on a regional scale, to maximize the regional skilled labour pool.	CR1	Information sharing with agencies, local government, State Government and community groups to plan, on a regional scale, to manage the impacts of an increased population. Adequate information sharing and planning will assist responsible parties to plan for any required amendments in the provision of services and facilities.

Local Business Development Plan cont.		Community Relations Management Plan cont.	
Id	**Key aspect**	**Id**	**Key aspect**
B2	Identify goods and services provision capacity in the region and develop and implement a policy of preferential regional procurement.	CR2	Behavioural protocols guiding interactions between Rex employees and the broader community to ensure positive integration and minimize potential areas of conflict. These protocols will inform an induction process for all new starters that highlights the cultural, social and environmental values of regional communities to assist newcomers to understand and appreciate the values held dear by those communities.
B**3**	Conduct training and awareness sessions for small businesses in the region to assist them to understand the potential supply opportunities to the Project and the Project's procurement requirements (ie, HSSE and quality standards). Rex will coordinate with agencies such as the Regional Development Authority on these initiatives.	CR3	Policy to support volunteering among its workforce and participation in community activities. Rex will do this by considering work rosters that enable participation in community clubs and associations, and attendance at community events.
B4	Consultation with the Community Consultative Group on the development of the Local Business Development Plan.	CR4	Support local volunteering groups, community clubs and associations, and events, as part of its community sponsorship program.
		CR5	Work with relevant authorities to ensure clear signage at intersections, 'hot spots' and 'hot times', access to crossings for pedestrians where necessary, and other safety measures exist, particularly in high pedestrian and traffic areas.
		CR6	Consultation with the Community Consultative Group on the development of the Community Relations Management Plan.

3.3 Impact Management

3.3.1 Land

The impacts of the Project related to land use (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Inconvenience to adjoining landholders

Rex will:

- [M1.1] as part of the Environmental component of its IMS, develop and implement an Air Quality Management Plan and a Noise and Vibration Management Plan to effectively manage issues of dust, noise and vibration.
- [M1.2] develop and implement a Communication Management Plan. The plan will include the aspects listed in Table 06 Social Management Plans.

- [M1.3] as part of the Environmental component of its IMS, develop and implement a Traffic Management Plan to manage vehicle movement on the site and in proximity to adjoining landholdings. The plan will include provisions for minimizing noise and dust from vehicle movements that may affect adjoining landholders, speed constraints, considerations for stock and stock movement and practices for entry and exit points.

Reduction in aesthetic value from change in existing land use

Rex will:

- [M2.1] develop and implement a Visual Amenity Management Plan. The plan will include the aspects listed in Table 06 Social Management Plans. Revegetation that occurs as part of the Native Vegetation Management Plan (part of the Environmental component of the IMS) will also contribute to minimising visual impact.
- [M2.2] in consultation with nearby land users, establish a regular routine of blasting to ensure associated effects of vibration and noise are known and expected by landholders through a Drill and Blast Management Plan (BMP) (from the Environmental component of the IMS). The BMP will consider noise and vibration impacts on stock and agricultural work practices. The blasting schedule will be promoted so landholders and the broader community are aware of it and changes to it will be advised to landholders and advertised to the broader community.

Changes to land value and industry types within region

Rex will:

- [M3.1] develop and implement a Local Employment Management Plan. The plan will include the aspects listed in Table 06 Social Management Plans.
- [M2.1] Visual Amenity Management Plan, refer Table 06 Social Management Plans.
- [M2.2] Drill and Blast Management Plan, refer Management Measure 2.2.

Disturbance or damage to heritage

Rex already has in place a heritage agreement and agreed cultural heritage management plans for heritage surveys and salvage of Aboriginal cultural heritage items that covers its exploration activities. Rex will

- [M4.1] develop and implement a Cultural Heritage Management Plan. The plan will include the aspects listed in Table 06 Social Management Plans.

3.3.2 Employment

The impacts of the Project related to employment (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Increased employment

The employment requirements of the mine, and possible multiplier effects for indirect employment, will significantly increase employment in the region. At Years 10 to 11 and again at mine closure, significant workforce reductions will occur.

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.

Increase in regional employment

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.

Increase in regional competition for skilled labour

While Rex's intention is to maximize the economic opportunity presented by the Project for residents of the Goyder SED region, it is mindful of the potential it has to deplete other businesses of skilled labour.

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.
- [M5.1] develop and implement a Local Business Development Plan. The plan will include the aspects listed in Table 06 Social Management Plans.

3.3.3 Local population

The impacts of the Project related to local population (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Increase in local population

- [M6.1] develop and implement a Community Relations Management Plan. The plan will include the aspects listed in Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Increase in volunteering and community participation

Rex acknowledges that volunteers contribute to the political, social, economic, environmental and cultural well-being of communities by:

- strengthening community cohesion, social wellbeing, and trust.
- expanding the ability of communities to respond to the needs of its residents and provide services and activities.
- engaging communities in protecting local resources and improving the physical environment.
- encouraging understanding of, and acceptance of, culture, diversity and difference.
- this policy includes clear procedures and processes to support volunteering

Rex will:

- [M6.1] Community Relations Management Plan, refer Table 06 Social Management Plans.

Effect on community cohesion

- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.
- [M6.1] Community Relations Management Plan, refer Table 06 Social Management Plans.
- [M5.1] Local Employment Management Plan, refer Table 06 Social Management Plans.

3.3.4 Health and wellbeing

The impacts of the Project related to community health and wellbeing (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Road safety from increased traffic associated with the Project

Rex will:

- [M1.3] as part of its Traffic Management Plan:
    - define acceptable routes, speeds, avoidance of school bus routes and avoidance of 'hot times' (ie, school drop-offs/pick-ups). The plan will also include safe driving awareness education
    - ensure all company vehicles have sufficient identification as a Rex vehicle, high visibility (ie, display flashing lights) and display contact information in the event of inappropriate driving or an incident.
- [M6.1] Community Relations Management Plan, refer Table 06 Social Management Plans.

Increased mental health issues associated with the presence of the Project

- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.
- [M2.1] Visual Amenity Management Plan, refer Table 06 Social Management Plans.
- [M2.2] Drill and Blast Management Plan, refer Management Measure 2.2.

Changes in lifestyle affecting health

- [M6.1] Community Relations Management Plan, Table 06 Social Management Plans
- [M7.1] as part of its Employee Health and Safety Management Plan (name to be confirmed):
    - provide healthy meal choices to its workforce and promote the benefits to people's health of making healthy food choices.
    - partner with relevant health agencies to provide free, basic, annual health checks to workers (ie, WorkSafe Victoria offers work health checks to businesses).
    - conduct drug and alcohol prevention programs that include awareness and detection activities.
    - consider funding or contributing to the development of a gym in Ardrossan for use by the broader community, subsiding workers' memberships.

3.3.5 Community services and facilities

The impacts of the Project related to community health and wellbeing (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Effect of increased population on health services

[M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Effect of increased population on education and childcare

[M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Effect of increased population on police and emergency services

- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.
- [M8.1] as part of the Emergency Response Management Plan, ensure its on-site mine rescue team conduct, at least annually, joint training with local emergency services to increase capacity and coordination.
- [M6.1] Community Relations Management Plan, refer Table 06 Social Management Plans.

Effect on retail and commercial services

- [M5.1] Local Business Development Plan, refer Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Effect of increased population on cultural and leisure facilities

- [M6.1] Community Relations Management Plan, refer Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

3.3.6 Infrastructure

The impacts of the Project related to infrastructure (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Effect of increased population and mine activities on transport infrastructure (roads)

Increased local traffic associated with rerouting of a section of the to the Yorke Highway along Pine Point Road will be managed through improved road constructing and intersections in accordance with Department of Planning Transport and Infrastructure requirements and management.

During construction of the amendments:

- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.
- [M1.3] Traffic Management Plan, refer Table 06 Social Management Plans.

Strategies to manage the potential impacts of increased traffic on community health and wellbeing are provided in Section 3.4 Health and wellbeing.

Effect of increased population and mine activities on power and water

[M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Effect of increased population and mine activities on waste management

[M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Improvements to infrastructure (ferry)

[M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

3.3.7 Housing and accommodation

The impacts of the Project related to housing and accommodation (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Increased population requirements for housing and accommodation

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Reduction in availability of housing and accommodation

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Reduction in housing and accommodation affordability

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

Reduction in housing and accommodation quality/standards

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.
- [M1.2] Communication Management Plan, refer Table 06 Social Management Plans.

3.3.8 Economy

The impacts of the Project related to the economy (described in Section 2 Potential impacts) will be managed by Rex in accordance with the following management plans.

Effect on economy

- [M3.1] Local Employment Management Plan, refer Table 06 Social Management Plans.
- [M5.1] Local Business Development Plan, refer Table 06 Social Management Plans.

4 Impact assessment

4.1 Land use

The impacts of the Project related to land use are outlined in Table 07 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 07 Land use impact assessment

Impact		Location	Timing. Duration. *(Construction, operations, closure, post-closure)*	Management measure		Residual impact assessment			
						Negative impact rating			Positive aspect
						Magnitude	Sensitivity	Residual Impact	
I1	Inconvenience to adjoining landholders	Mine site	Construction to post-closure.	M1.1	Air Quality Management Plan Noise and Vibration Management Plan	L	L	Mi	
				M1.2	Communication Management Plan				
				M1.3	Traffic Management Plan				
I2	Reduction in aesthetic value from change in existing land use	Mine site	Construction to post-closure.	M2.1	Visual Amenity Management Plan	L	M	Mi	
				M2.2	Drill and Blast Management Plan				
I3	Changes to land value and industry types within region	Region	Construction to post-closure.	M3.1	Local Employment Management Plan	M	M	Mo	✓
				M2.1	Visual Amenity Management Plan				
				M2.2	Drill and Blast Management Plan				
I4	Disturbance or damage to heritage	Mine site, exploration areas	Construction.	M4.1	Cultural Heritage Management Plan	L	L	N	

Rationale for Assessment

Inconvenience to adjoining landholders

Irrespective of the effectiveness of the management measures, the Project is likely to inconvenience adjoining landholders from time-to-time. The effectiveness of the management measures will ensure these occurrences are irregular and minimal. Landholders will have the opportunity to contribute to the development of protocols, be aware of planned activities, and have the opportunity to raise concerns. The magnitude has therefore been determined as **low**,

having a minor impact that is isolated and confined within the Project footprint and immediate surrounds. The sensitivity has been determined to be **medium** because, while landholders will adapt to these changes, they are likely to do so reluctantly and perceive inconvenience regardless of level of actual impact. This results in an overall residual impact rating of **minor**.

Reduction in aesthetic value from change in existing land use

The extent to which the Project will reduce aesthetic value from change in existing land use, given the management measures will minimize the visual and noise impacts, results in effects being confined to close proximity of the Project footprint. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **medium** because of the importance of agricultural values of the area held by the regional community. This results in an overall residual impact rating of **minor**.

Changes to land value and industry types within region

The extent to which the Project will change land values within the region is likely to have an impact on the economy, the effects will extend across the region and are likely to be medium to long term. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **medium** because communities have resilience to adapt to this impact and there are already some signs of this impact in the community. This results in an overall residual impact rating of **moderate**. In some instances this impact may be negative, while in others, a positive effect may result, as described in Section 2.1.3 Changes to land value and industry types within region.

Disturbance or damage to heritage

With the cultural heritage management plan already in place and potential effects confined within the Project footprint, the magnitude has been determined as **low**. The sensitivity has been determined to be **low** because the heritage contained on the site is considered to have only local value or recognition. This results in an overall residual impact rating of **negligible**.

4.2 Employment

The impacts of the Project related to employment are outlined in Table 08 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 08 Employment impact assessment

Impact		Location	Timing. Duration. *(Construction, operations, closure, post-closure)*	Management measure		Residual impact assessment			
						Negative impact rating			Positive aspect
						Magnitude	Sensitivity	Residual Impact	
I5	Increased employment	Region	Construction to closure	M3.1	Local Employment Management Plan	P	P	P	✓
I6	Increase in regional employment	Region	Construction to closure	M3.1	Local Employment Management Plan	P	P	P	✓
I7	Increase in regional competition for skilled labour	Region	Construction to closure	M3.1	Local Employment Management Plan	M	M	Mo	✓
				M5.1	Local Business Development Plan				

Rationale for Assessment

Increased employment

The effect of this impact will be positive.

Increase in regional employment

The effect of this impact will be positive.

Increase in regional competition for skilled labour

The Project will increase regional competition for skilled labour to the extent that the Project and other businesses may be unable to source skilled labour for some positions from within the region. This effect is likely to be medium- to long-term. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **medium** because the community will likely have some resilience to change (in accepting newcomers and increasing the overall skill pool) and exposure to this impact is already evident in the region with other mines and industry already competing for skilled labour across the State. This results in an overall residual impact rating of **moderate.** There is also the potential for positive impact from increasing the overall skilled labour pool through training and education and with the relocation of new residents to the area, as described in Section 2.2.3 Increase in regional competiton for skilled labour.

4.3 Local population

The impacts of the Project on local population are outlined in Table 09 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 09 Local population impact assessment

Impact		**Location**	**Timing. Duration.** *(Construction, operations, closure, post-closure)*	**Management measure**		**Residual impact assessment**			
						Negative impact rating			**Positive aspect**
						Magnitude	**Sensitivity**	**Residual Impact**	
I8	Increase in local population	Region	Construction to closure	M3.1	Local Employment Management Plan	M	M	Mo	✓
				M1.2	Communication Management Plan				
I9	Increase in volunteering and community participation	Region	Construction to closure	M3.1	Local Employment Management Plan	P	P	P	✓
				M6.1	Community Relations Management Plan				
I10	Effects on community cohesion	Region	Construction to closure	M1.2	Communication Management Plan	L	M	Mi	✓
				M3.1	Local Employment Management Plan				
				M6.1	Community Relations Management Plan				

Rationale for Assessment

Increase in local population

The extent to which the Project will modify the local population will impact on the regional economy and affect the region for the medium- to long-term. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **medium** because there are already some signs of exposure to this impact evident in the region. This results in an overall residual impact rating of **moderate**. In some instances this impact may be negative, while in others, a positive effect may result, as described in Section 2.3.1 Increase in local population.

Increase in volunteering and community participation

The effect of this impact will be positive.

Effects on community cohesion

With successful implementation of the management strategies, the extent to which the Project will modify community cohesion in regional communities is likely to result only in minor community effect confined to isolated locations outside the Project footprint. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **medium** because communities will have some resilience to change. This results in an overall residual impact rating of **minor**. In some instances this impact may be negative, while in others, a positive effect may result, as described in Section 2.3.3 Effect on community cohesion.

4.4 Health and wellbeing

The impacts of the Project on health and wellbeing are outlined in Table 10. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 10 Health and wellbeing impact assessment

Impact		**Location**	**Timing. Duration.** *(Construction, operations, closure, post-closure)*	**Management measure**		**Residual impact assessment**			
						Negative impact rating			**Positive aspect**
						Magnitude	**Sensitivity**	**Residual Impact**	
I11	Road safety from increased traffic associated with the Project	Mine site, region	Construction to closure	M1.3	Traffic Management Plan	M	M	Mo	✓
				M6.1	Community Relations Management Plan				
I12	Increased mental health issues associated with the presence of the Project	Region	Construction to closure	M1.2	Communication Management Plan	L	M	Mi	
				M2.1	Visual Amenity Management plan				
				M2.2	Drill and Blast Management Plan				
I13	Changes in lifestyle affecting health	Region	Construction to closure	M6.1	Community Relations Management Plan	L	M	Mi	✓
				M7.1	Employee Health and Safety Management Plan				

Rationale for Assessment

Road safety from increased traffic associated with the Project

The Project will affect road safety due to increased traffic that may require review and change in process due to community complaints. The likelihood of people requiring treatment and hospitalisation from accidents may occur. However, the effects of increased traffic will alleviate in the medium- to long-term. With the proposed management measures, the magnitude has therefore been determined as **medium.** The sensitivity has been determined to be **medium**

because communities will have some resilience to adapt to increased traffic to preserve their safety. This results in an overall residual impact rating of **moderate**. There is potential that improvements to road infrastructure may have a positive impact on road safety, as described in Section 2.6.1 Effect of increased population and mine activities on transport infrastructure (roads).

Increased mental health issues associated with the presence of the Project

The extent to which the Project will increase mental health will be difficult to determine but likely to be isolated, affecting only a small number of people likely with close proximity to the Project footprint. Therefore the magnitude has been determined as **low.** The sensitivity has been determined as **medium**, as individuals will have some resilience to change resulting from the Project. Therefore the overall residual impact has been rated as **minor.**

Changes in lifestyle affecting health

The extent to which the Project will affect health due to changes in lifestyle will likely be minor, with low level impacts on quality of life confined within isolated areas outside the Project area. The magnitude has therefore been determined as **low.** The sensitivity has been determined as **medium**, as individuals will have some resilience to change resulting from the Project. Therefore the overall residual impact has been rated as **minor.** There is potential that increased services or health initiatives supported by Rex may have a positive impact on lifestyles affecting health, as described in Section 2.4.3 Changes in lifestyle affecting health.

4.5 Community services and facilities

The impacts of the Project on community services and facilities are outlined in Table 11 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 11 Community services and facilities impact assessment

Impact		**Location**	**Timing. Duration.** *(Construction, operations, closure, post-closure)*	**Management measure**		**Residual impact assessment**			
						Negative impact rating			**Positive aspect**
						Magnitude	**Sensitivity**	**Residual Impact**	
I14	Effects of increased population on health services	Region	Construction to closure	M1.2	Communication Management Plan	L	L	N	✓
I15	Effects of increased population on education and childcare	Region	Construction to closure	M1.2	Communication Management Plan	L	L	N	✓

Impact		Location	Timing. Duration. *(Construction, operations, closure, post-closure)*	Management measure		Residual impact assessment			
						Negative impact rating			Positive aspect
						Magnitude	Sensitivity	Residual Impact	
I16	Effects of increased population on police and emergency services	Region	Construction to closure	M1.2	Communication Management Plan	L	M	Mi	✓
				M8.1	Emergency Response Management Plan				
				M6.1	Community Relations Management Plan				
I17	Effect on retail and commercial services	Region	Construction to closure	M5.1	Local Business Development Plan	P	P	P	✓
				M1.2	Communication Management Plan				
I18	Effects of increased population on cultural and leisure facilities	Region	Construction to closure	M6.1	Community Relations Management Plan	P	P	P	✓
				M1.2	Communication Management Plan				

Rationale for Assessment

Effects of increased population on health services

The extent to which increased population will affect access to health services is likely to be minor, given the extent of services that exist in the region. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **low** because little or no change will be required by communities. This results in an overall residual impact rating of **negligible**. There is potential that increased population will have a positive impact on increasing health services, as described in Section 2.5.1 Effect of increased population on health services.

Effects of increased population on education and childcare

The extent to which increased population will affect access to education and childcare services is likely to be minor, given the extent of services that exist in the region. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **low** because little or no change will be required by communities. This results in an overall residual impact rating of **negligible**. There is potential that increased population will have a positive impact on increasing education and childcare services, as described in Section 2.5.2 Effect of increased population on education and childcare.

Effects of increased population on police and emergency services

The extent to which increased population will affect access to police and emergency services is likely to be minor and confined to isolated locations outside the Project location. The magnitude

has therefore been determined as **low**. The sensitivity has been determined to be **medium** because there are some signs of exposure to this impact already evident across the region (with reported inadequacies in police presence and reliance on volunteers for some emergency services). This results in an overall residual impact rating of **minor**. There is potential that increased population will have a positive impact on police and emergency services if police presence is boosted and participation in volunteering increases, as described in Section 2.5.3 Effect of increased population on police and emergency services

Effect on retail and commercial services

The effect of this impact will be positive.

Effects of increased population on cultural and leisure facilities

The effect of this impact will be positive.

4.6 Infrastructure

The impacts of the Project on infrastructure are outlined in Table 12 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 12 Infrastructure impact assessment

Impact		**Location**	**Timing. Duration.** *(Construction, operations, closure, post-closure)*	**Management measure**		**Residual impact assessment**			
						Negative impact rating			**Positive aspect**
						Magnitude	**Sensitivity**	**Residual Impact**	
I19	Effect of increased population and mine activities on transport infrastructure (roads)	Mine site, region	Construction to closure	M1.2	Communication Management Plan	M	M	Mo	✓
				M1.3	Traffic Management Plan				
I20	Effect of increased population and mine activities on power and water	Region	Construction to closure	M1.2	Communication Management Plan	L	L	N	✓
I21	Effect of increased population and mine activities on waste management	Region	Construction to closure	M1.2	Communication Management Plan	L	L	N	
I22	Improvements to infrastructure	Region	Construction to closure	M1.2	Communication Management Plan	P	P	P	✓

Rationale for Assessment

Effect of increased population and mine activities on transport infrastructure (roads)

The extent to which increased population and mine activities will affect transport infrastructure is likely to be substantial in some locations (particularly along the Pine Point Road rerouted to become the Yorke Highway), and result in persistent and widespread stakeholder concern. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **moderate** because communities will have the ability to adapt to changes in transport infrastructure and conditions and are already exposed to heavy traffic and significant fluctuations in traffic volumes during peak and off-peak seasons. This results in an overall residual impact rating of **moderate**. This impact will also have some positive effects in improving safety and visual amenity of some roads, as described in Section 2.6.1 Effect of increased population and mine activities on transport infrastructure (roads).

Effect of increased population and mine activities on power and water

Effects on power are expected to be isolated and short-term and no effects on water are expected. At worst, issues relating to power and water would be expected to attract only localised stakeholder concern. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **low** because communities area already affected by interruptions to power supply in peak times. This results in an overall residual impact rating of **negligible**. This impact may also have some positive effects if expansions to water and power supply capacity results to accommodate population increases. This impact may also have some positive effects in improving power and water infrastructure, as described in Section 2.6.2 Effect of increased population and mine activities on power and water.

Effect of increased population and mine activities on waste management

Any effects to waste management would likely attract only localised stakeholder concern within isolated locations outside the Project footprint. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **low** because of the low importance communities place on waste management and their adaptability if alternative waste management measures were required in the future. This results in an overall residual impact rating of **negligible**.

Improvements to infrastructure

The effect of this impact will be positive.

4.7 Housing and accommodation

The impacts of the Project on housing and accommodation are outlined in Table 13 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 13 Housing and accommodation impact assessment

Impact		Location	Timing. Duration. *(Construction, operations, closure, post-closure)*	Management measure		Residual impact assessment			
						Negative impact rating			Positive aspect
						Magnitude	Sensitivity	Residual Impact	
I23	Increased population requirements for housing and accommodation	Region	Construction to closure	M3.1	Local Employment Management Plan	M	M	Mo	✓
				M1.2	Communication Management Plan				
I24	Reduction in availability of housing and accommodation	Region	Construction to closure	M3.1	Local Employment Management Plan	M	M	Mo	
				M1.2	Communication Management Plan				
I25	Reduction in housing and accommodation affordability	Region	Construction to closure	M3.1	Local Employment Management Plan	M	M	Mo	
				M1.2	Communication Management Plan				
I26	Reduction in housing and accommodation quality/ standards	Region	Construction to closure	M3.1	Local Employment Management Plan	L	M	Mi	
				M1.2	Communication Management Plan				

Rationale for Assessment

Increased population requirements for housing and accommodation

The extent to which the Project will increase housing and accommodation needs will be felt across the region and have, potentially, a notable impact on the economy for the medium- to long-term. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **moderate** because some signs of exposure to this impact have already evident during peak tourism times. This results in an overall residual impact rating of **moderate**. This impact will also have some positive effects for landlords and providers of temporary accommodation, as described in Section 2.7.1 Increased population requirements for housing and accommodation.

Reduction in availability of housing and accommodation

The extent to which the Project will reduce the availability of housing and accommodation will be felt across the region and have, potentially, a notable impact on the economy for the medium- to long-term. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **moderate** because some signs of exposure to this impact have already evident during peak tourism times. This results in an overall residual impact rating of **moderate**.

Reduction in housing and accommodation affordability

The extent to which the Project will reduce the affordability of housing and accommodation will be felt across the region and have, potentially, a notable impact on the economy for the medium- to long-term. The magnitude has therefore been determined as **medium**. The sensitivity has been determined to be **moderate** because some signs of exposure to this impact have already evident during peak tourism times. This results in an overall residual impact rating of **moderate**.

Reduction in housing and accommodation quality/ standards

The extent to which the Project may affect the quality/standards of housing and accommodation in the region is likely to be confined to isolated locations outside the Project area. The magnitude has therefore been determined as **low**. The sensitivity has been determined to be **moderate** because, while it would be undesirable, communities and individual have some resilience to adapt to these changes. This results in an overall residual impact rating of **minor**.

4.8 Economy

The impacts of the Project on economy are outlined in Table 14 below. The table identifies whether the impact is positive or negative, where it is likely to occur, the timing and duration for which it is likely to occur, recommended management measure, and residual impact rating.

Table 14 Economy impact assessment

Impact		**Location**	**Timing. Duration.** *(Construction, operations, closure, post-closure)*	**Management measure**		**Residual impact assessment**			
						Negative impact rating			**Positive aspect**
						Magnitude	**Sensitivity**	**Residual Impact**	
I27	Effect on economy	Region, State, nation	Construction to closure	M3.1	Local Employment Management Plan	P	P	P	✓
				M5.1	Local Business Development Plan				

Rationale for Assessment

Effect on economy

The effect of this impact will be positive.

5 Socio-economic assessment summary

Table 15 Summary of socio-economic impacts, management measures, residual impact rating and management objective

Impact		Management measure		Residual impact assessment			Positive aspect	Management objective
				Magnitude	Sensitivity	Residual Impact		
Land use								
I1	Inconvenience to adjoining landholders	M1.1	Air Quality Management Plan Noise and Vibration Management Plan	L	L	N		Minimise or avoid potentially negative impacts of the Project on land use, particularly for directly affected landholders and traditional owners.
		M1.2	Communication Management Plan					
		M1.3	Traffic Management Plan					
I2	Reduction in aesthetic value from change in existing land use	M2.1	Visual Amenity Management Plan	L	M	Mi		
		M2.2	Drill and Blast Management Plan					
I3	Changes to land value and industry types within region	M3.1	Local Employment Management Plan	M	M	Mo	✓	
		M2.1	Visual Amenity Management Plan					
		M2.2	Drill and Blast Management Plan					
I4	Disturbance or damage to heritage	M4.1	Cultural Heritage Management Plan	L	L	N		
Employment								
I5	Increased employment	M3.1	Local Employment Management Plan	P	P	P	✓	Economic benefits of the Project are largely retained within the region.
I6	Increase in regional employment	M3.1	Local Employment Management Plan	P	P	P	✓	
I7	Increase in regional competition for skilled labour	M3.1	Local Employment Management Plan	M	M	Mo	✓	
		M6.1	Local Business Development Plan					

Impact		Management measure		Residual impact assessment			Positive aspect	Management objective
				Magnitude	Sensitivity	Residual Impact		
Local Population								
I8	Increase in local population	M3.1	Local Employment Management Plan	M	M	Mo	✓	Increased population improves community sense of value and agreeableness of living on Yorke Peninsula.
		M1.2	Communication Management Plan					
I9	Increase in volunteering and community participation	M3.1	Local Employment Management Plan	P	P	P	✓	
		M6.1	Community Relations Management Plan					
I10	Effects on community cohesion	M1.2	Communication Management Plan	L	M	Mi	✓	
		M3.1	Local Employment Management Plan					
		M6.1	Community Relations Management Plan					
Health and wellbeing								
I11	Road safety from increased traffic associated with the Project	M1.3	Traffic Management Plan	M	M	Mo	✓	Minimise or avoid potentially negative impacts of the Project on community health and wellbeing.
		M6.1	Community Relations Management Plan					
I12	Increased mental health issues associated with the presence of the Project	M1.2	Communication Management Plan	L	M	Mi		
		M2.1	Visual Amenity Management plan					
		M2.2	Drill and Blast Management Plan					
I13	Changes in lifestyle affecting health	M6.1	Community Relations Management Plan	L	M	Mi	✓	
		M7.1	Employee Health and Safety Management Plan					
Community services and facilities								
I14	Effects of increased population on health services	M1.2	Communication Management Plan	L	L	N	✓	Community services and facilities are adequate to meet residents' needs.
I15	Effects of increased population on education and childcare	M1.2	Communication Management Plan	L	L	N	✓	

Impact		Management measure		Residual impact assessment			Positive aspect	Management objective
				Magnitude	Sensitivity	Residual Impact		
I16	Effects of increased population on police and emergency services	M1.2	Communication Management Plan	L	M	Mi	✓	
		M8.1	Emergency Response Management Plan					
		M6.1	Community Relations Management Plan					
I17	Effect on retail and commercial services	M5.1	Local Business Development Plan	P	P	P	✓	
		M1.2	Communication Management Plan					
I18	Effects of increased population on cultural and leisure facilities	M6.1	Community Relations Management Plan	P	P	P	✓	
		M1.2	Communication Management Plan					
Infrastructure								
I19	Effect of increased population and mine activities on transport infrastructure (roads)	M1.2	Communication Management Plan	M	M	Mo	✓	Regional infrastructure is adequate to meet residents' needs.
		M1.3	Traffic Management Plan					
I20	Effect of increased population and mine activities on power and water	M1.2	Communication Management Plan	L	L	N	✓	
I21	Effect of increased population and mine activities on waste management	M1.2	Communication Management Plan	L	L	N		
I22	Improvements to infrastructure	M1.2	Communication Management Plan	P	P	P	✓	
Housing and accommodation								
I23	Increased population requirements for housing and accommodation	M3.1	Local Employment Management Plan	M	M	Mo	✓	Sufficient housing and accommodation is available in the region to fulfil existing and future residents' needs.
		M1.2	Communication Management Plan					
I24	Reduction in availability of housing and accommodation	M3.1	Local Employment Management Plan	M	M	Mo		
		M1.2	Communication Management Plan					
I25	Reduction in housing and accommodation affordability	M3.1	Local Employment Management Plan	M	M	Mo		
		M1.2	Communication Management Plan					
I26	Reduction in housing and accommodation quality/ standards	M3.1	Local Employment Management Plan	L	M	Mi		
		M1.2	Communication Management Plan					

Impact		Management measure		Residual impact assessment			Positive aspect	Management objective
				Magnitude	Sensitivity	Residual Impact		
Economy								
I27	Effect on economy	M3.1	Local Employment Management Plan	P	P	P	✓	Economic benefits of the Project are largely retained within the region.
		M6.1	Local Business Development Plan					

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Rex Minerals
4 July 2013
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Hillside Mine

Construction noise and vibration management plan

Hillside Mine

Construction noise and vibration management plan

Prepared for

Rex Minerals

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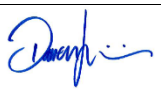
Reviewed by Simon Moore

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	12-Dec-2012	Initial issue	Simon Moore Principal Engineer - Acoustics	
1	08-Jan-2013	Minor updates	Darren Jurevicius Technical Director - Acoustics	
2	14-Jan-2013	Updates to noise sensitive receivers	Darren Jurevicius Technical Director - Acoustics	
3	04-Jul-2013	Updates to noise assessment	Darren Jurevicius Technical Director - Acoustics	

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Glossary

A-Weighting	The “A” weighting scale is designed to adjust the absolute sound pressure levels to correspond to the subjective response of the human ear.
dB(A)	A-Weighted sound pressure level measured in decibels.
Hz	Hertz. The number of cycles per second, referring to the frequency of sound or vibration.
L_p	Sound Pressure Level - The fluctuation of atmospheric pressure from mean atmospheric pressure, expressed in decibels relative to 2 x 10^{-5} Pascals.
L_{Aeq}	Equivalent (energy averaged) noise level measured over a time period. This noise descriptor is commonly used in environmental noise policies and assessments. The time period the measurement is averaged over may be included in the subscript, i.e. $L_{Aeq,10min}$
L_{Amax}	The maximum A-Weighted noise level recorded over a measurement period
L_{Amin}	The minimum A-Weighted noise level recorded over a measurement period
L_{A90}	Noise level exceeded 90% of the measurement period. This descriptor is used to represent the background noise level.
PPV	Peak Particle Velocity. The rate at which a particle of ground is moving, i.e. a measure of ground vibration in millimetres per second.
rms	Root mean square

1.0 Introduction

This Construction Noise and Vibration Management Plan (CNVMP) has been prepared by AECOM to support the construction phase of the Hillside Mine and Port facility near Ardrossan, South Australia.

This CNVMP:

- defines the location and type of sensitive land uses in the project area
- specifies noise level targets at sensitive receivers for construction noise
- specifies vibration criteria at sensitive receivers for construction vibration
- outlines indicative future noise and vibration levels from construction activities
- evaluates the indicative noise and vibration levels
- develops proactive management initiatives
- outlines practical mitigation options.

The objectives of the CNVMP are to:

- ensure that unavoidable noise impacts are minimised to the extent practicable during construction
- outline appropriate procedures to minimise vibration impacts
- establish mitigation measures to be adopted during construction
- minimise impacts on the broader community and local businesses by expediting completion of construction as much as possible.

2.0 Project description

The Hillside Mine site is located approximately 12 km south of Ardrossan, South Australia, as shown in Figure 1. The development also includes a port facility to be located in Ardrossan, adjacent to the existing Arrium port facility, and a pipeline between the mine and port facility.

This CNVMP is intended to cover the construction phase of the Hillside Mine, port facility, and pipeline. We understand that construction phase activities will include:

- preparation of sites (land clearing, levelling)
- construction of site buildings
- construction of on-site plant
- construction of site infrastructure
- construction of the port facility
- construction of pipeline and associated infrastructure between mine and port
- construction of public roads diverted around the mine site

Note that this CNVMP does not cover activities that are part of mine operation. Any activities which use plant from the mine such as digging, blasting, removal of over-burden, etc. are considered to be a part of mine operations. The assessment of noise from mine operations is to be covered under the Operational Noise Report for the mine.

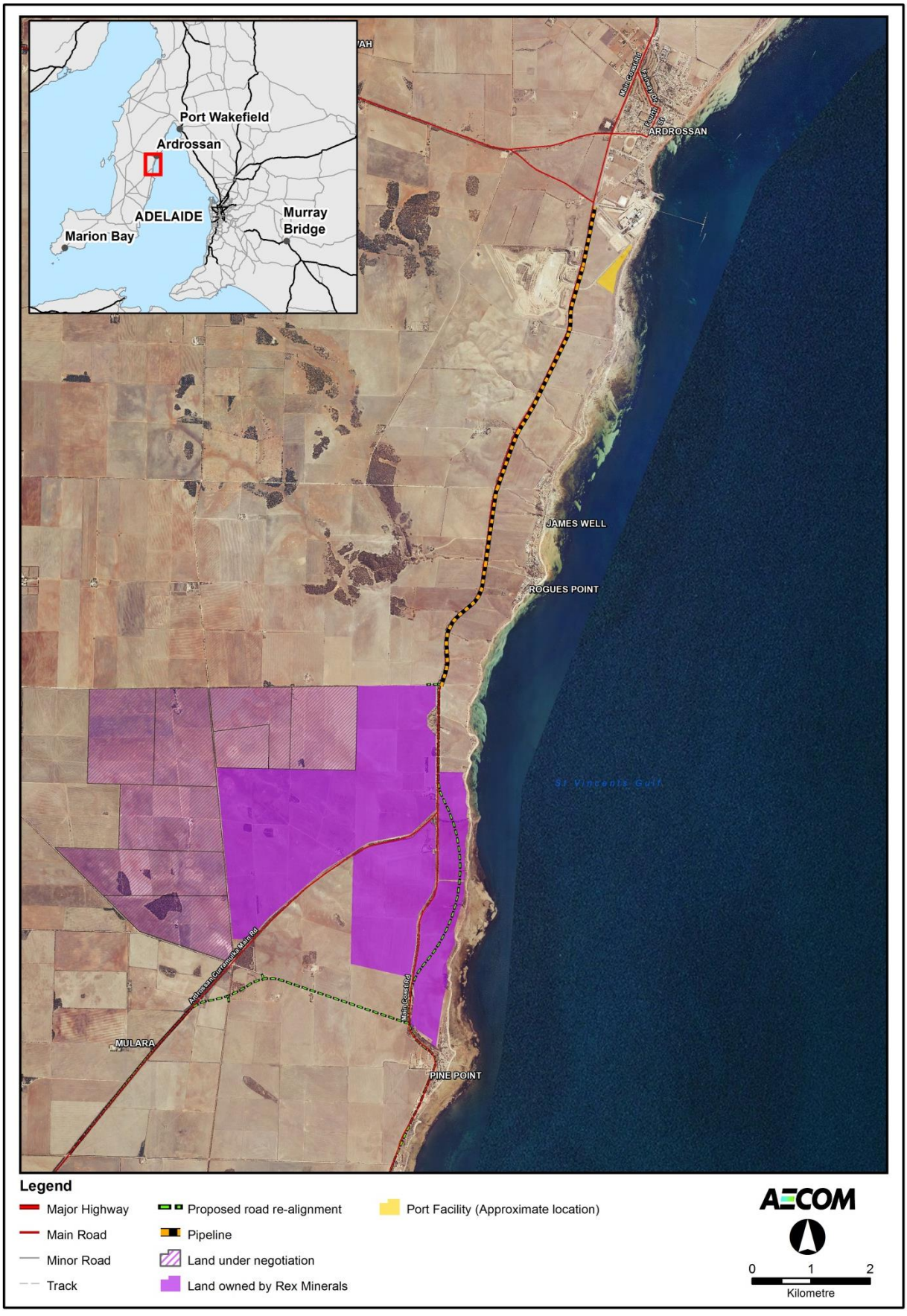

Figure 1 Proposed site for the Hillside Mine development

3.0 Nearest sensitive receivers

The type of land uses typically considered sensitive to noise and vibration impacts include developed residential properties as well as educational institutions, childcare centres, kindergartens and nursing homes. Offices and heritage listed structures are also sensitive to vibration impacts from construction.

In the rural area surrounding the mine site, the nearest sensitive receivers are residential properties. The closest of these are shown in Figure 2.

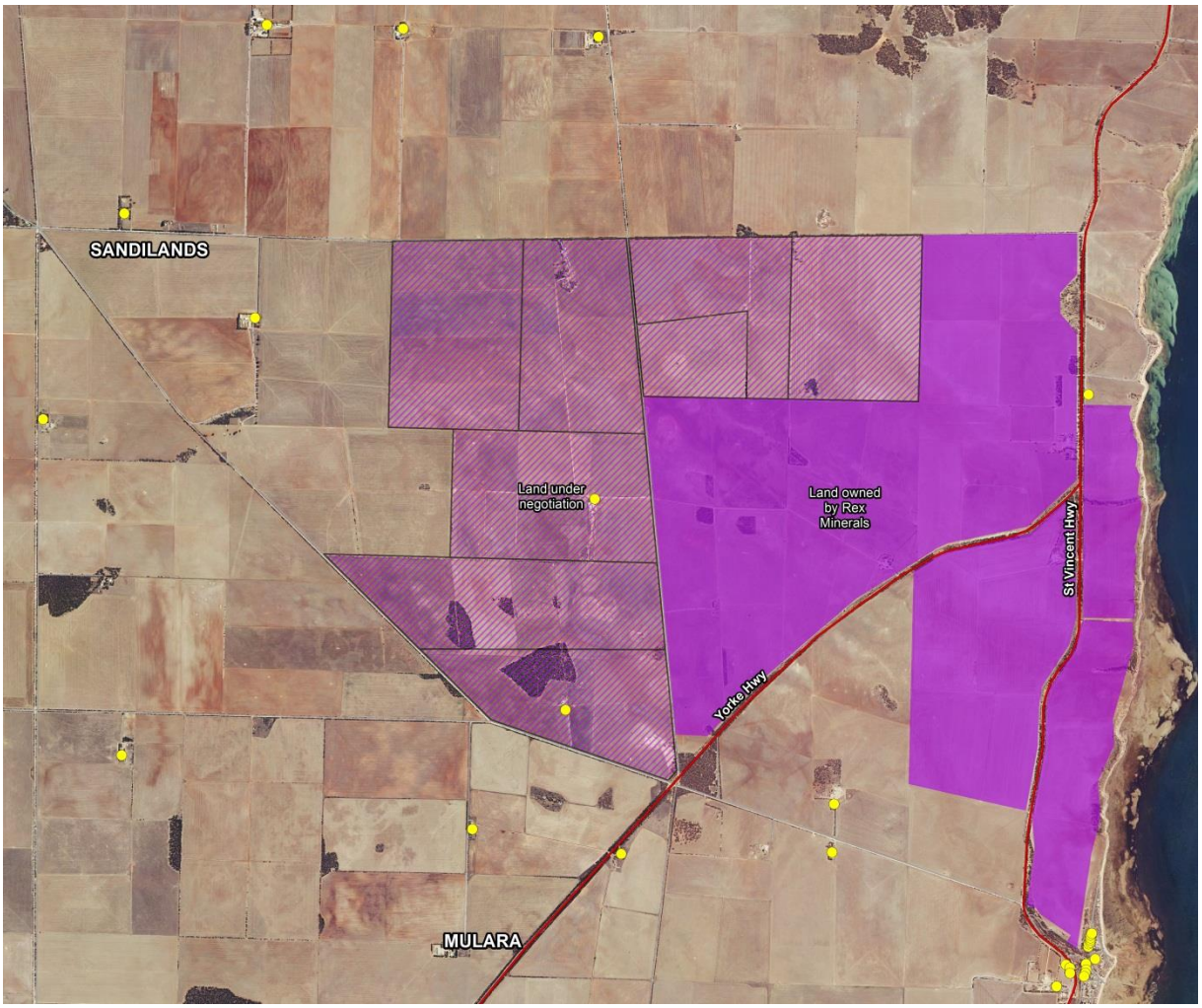

Figure 2 Hillside mine site and nearest noise and vibration sensitive receivers

The nearest sensitive receivers to the port facility are houses in Ardrossan 1.2 km to the North, and a residence approximately 1 km to the South of the facility, as shown in Figure 3.

Figure 3 Port facility site and nearest noise and vibration sensitive receivers

For the road diversion construction, the nearest sensitive receiver is located approximately 100m south of the road reserve, shown in Figure 4.

Figure 4 Proposed road realignment showing nearest noise and vibration sensitive receivers

3.1 Pre-construction noise monitoring

Measurements of existing noise levels in the areas surrounding the mine and port sites were undertaken during the period 14 – 28 August 2012, and results were reported in AECOM report 60279709-A12K01RP (Pre-Construction Noise Monitoring Report). Selected results from this report have been included below, for monitoring locations that correspond to noise and vibration sensitive receivers for the construction of the mine site, port facility, pipeline, and road realignment. A map showing these noise monitoring locations is included in Figure 5.

3.1.1 Location 1 – Hogarth Street, Ardrossan

The residence at Hogarth Street, Ardrossan is in a block of houses to the North of the port facility. Noise monitoring was undertaken at this location from 14 August – 20 August 2012. Table 1 presents results of noise monitoring at Location 1 for the night-time period.

Table 1 Location 1 Pre-construction noise monitoring results

Date	$L_{Aeq,9hr}$
14/08/2012	42
15/08/2012	42
16/08/2012	52
17/08/2012	41
18/08/2012	41
19/08/2012	42
20/08/2012	42
Median	**42**

3.1.2 Location 2 – Residence off BHP Road

Location 2 is a residence off BHP Road, South of the port facility. Two attended measurements were taken at this location at approximately 11:30pm, results of which are presented in Table 2.

Table 2 Location 2 Pre-construction noise monitoring results

Date	$L_{Aeq,15min}$
14/08/2012	22
21/08/2012	36

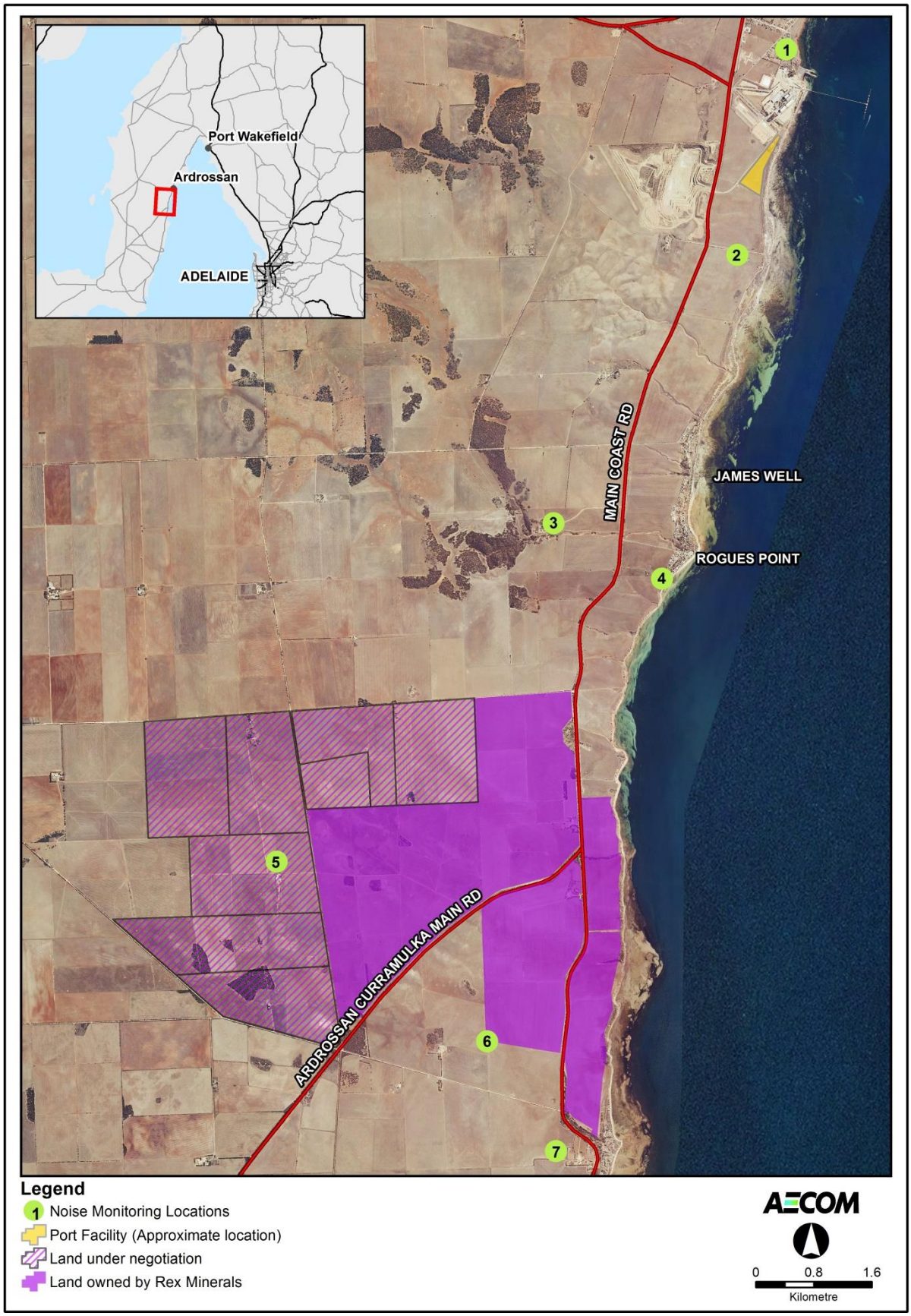

Figure 5 Pre-construction noise monitoring locations

3.1.3 Location 3 – Residence off Yorke Highway

Location 3 is at a residence off the Yorke Highway, North of the mine site. Noise monitoring was undertaken at this location from 14 August until 28 August 2012. Results from the noise monitoring are shown in Table 3.

Table 3 Location 3 Pre-construction noise monitoring results

Date	$L_{Aeq,9hr}$
14/08/2012	39
15/08/2012	35
16/08/2012	50
17/08/2012	38
18/08/2012	39
19/08/2012	36
20/08/2012	48
21/08/2012	40
22/08/2012	45
23/08/2012	49
24/08/2012	39
25/08/2012	36
26/08/2012	41
27/08/2012	41
28/08/2012	37
Median	**39**

3.1.4 Location 4 – Rogues Point Residence

Location 4 is at a residence at Rogues Point, North-east of the mine site. Noise monitoring was undertaken at this location from 14 August until 28 August 2012. Results from the noise monitoring are shown in Table 4.

Table 4 Location 4 Pre-construction noise monitoring results

Date	$L_{Aeq,9hr}$
14/08/2012	39
15/08/2012	42
16/08/2012	56
17/08/2012	41
18/08/2012	36
19/08/2012	40
20/08/2012	54
21/08/2012	37
22/08/2012	49
23/08/2012	49
24/08/2012	41
25/08/2012	37

Date	$L_{Aeq,9hr}$
26/08/2012	39
27/08/2012	43
28/08/2012	41
Median	**41**

3.1.5 Location 5 – Residence off Reddings Road, West of mine site

Location 5 is a residence to the West of the mine site. Noise monitoring was undertaken at this location from 14 August until 28 August 2012. Results from the noise monitoring are shown in Table 5.

Table 5 Location 5 Pre-construction noise monitoring results

Date	$L_{Aeq,9hr}$
14/08/2012	31
15/08/2012	35
16/08/2012	54
17/08/2012	33
18/08/2012	29
19/08/2012	34
20/08/2012	51
21/08/2012	35
22/08/2012	46
23/08/2012	46
24/08/2012	29
25/08/2012	30
26/08/2012	41
27/08/2012	39
28/08/2012	40
Median	**35**

3.1.6 Location 6 – Residence South-west of mine site

Location 6 is a residence South-west of the mine site. Noise monitoring was undertaken on Rex Minerals owned land within 600 m of this location, from 14 August until 28 August 2012. Results from the noise monitoring are shown in Table 6.

Table 6 Location 6 Pre-construction noise monitoring results

Date	$L_{Aeq,9hr}$
14/08/2012	35
15/08/2012	41
16/08/2012	58
17/08/2012	38
18/08/2012	33

Date	$L_{Aeq,9hr}$
19/08/2012	37
20/08/2012	61
21/08/2012	31
22/08/2012	52
23/08/2012	55
24/08/2012	32
25/08/2012	31
26/08/2012	36
27/08/2012	46
28/08/2012	35
Median	**37**

3.1.7 Location 7 – Pine Point residence

Location 7 is a residence South-east of the mine site in Pine Point. Noise monitoring was undertaken at a location 400 m North-east of the residence, from 14 August until 28 August 2012. Results from the noise monitoring are shown in Table 7.

Table 7 Location 7 Pre-construction noise monitoring results

Date	$L_{Aeq,9hr}$
14/08/2012	32
15/08/2012	32
16/08/2012	50
17/08/2012	31
18/08/2012	29
19/08/2012	34
20/08/2012	50
21/08/2012	34
22/08/2012	46
23/08/2012	42
24/08/2012	31
25/08/2012	29
26/08/2012	34
27/08/2012	35
28/08/2012	33
Median	**34**

4.0 Assessment criteria

4.1 Noise

4.1.1 Environmental Protection Act 1993 - General Environmental Duty

Clause 25 of the *Environment Protection Act 1993* provides the following General Environmental Duty:

"*A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.*"

4.1.2 Environment Protection (Noise) Policy 2007

The *Environment Protection (Noise) Policy 2007* (Noise EPP) provides specific criteria for construction noise under *Part 6—Special noise control provisions, Division 1—Construction noise* for which compliance with will satisfy the General Environmental Duty.

Under the Policy, construction activity with an adverse impact on amenity must not occur on a Sunday or other public holiday, and on any other day except between 7.00am and 7.00pm. The following criteria are applicable at noise-affected premises for determining whether construction activities result in noise with an adverse impact on amenity:

- The equivalent source noise level ($L_{Aeq,15min}$) should not exceed 45 dB(A).
- The maximum source noise level (L_{Amax}) should not exceed 60 dB(A).

However, if the ambient noise levels at the noise-affected premises exceed the 45 dB(A) equivalent noise criteria or consistently exceed the 60 dB(A) maximum noise criteria, the construction activity does not result in noise with an adverse impact on amenity unless:

- Equivalent source noise levels ($L_{Aeq,15min}$) exceed the ambient noise level ($L_{Aeq,15min}$).
- Maximum source noise levels (L_{Amax}) consistently exceed the maximum ambient noise level (L_{Amax}) or the frequency of occurrence of the maximum ambient noise level (L_{Amax}).

A particular operation may occur on a Sunday or public holiday between 9.00am and 7.00pm, or may commence before 7.00am on any other day to avoid an unreasonable interruption of vehicle or pedestrian traffic movement or if other grounds exist that the Authority or other administering agency determines to be sufficient.

If a construction activity results in noise with an adverse impact on amenity, all reasonable and practicable measures must be taken to minimise noise resulting from the activity to minimise its impact. This includes (but is not limited to) the following measures to the extent practicable:

- Scheduling particularly noisy activities to commence after 9.00am where reasonable and practicable to do so.
- Locating noisy equipment (such as masonry saws) or processes so that their impact on neighbouring premises is minimised (whether by maximising the distance to the premises, using structures or elevations to create barriers or otherwise).
- Shutting or throttling equipment down whenever it is not in actual use.
- Ensuring that noise reduction devices such as mufflers are fitted and operating effectively; and
- Ensuring that equipment is not operated if maintenance or repairs would eliminate or significantly reduce a characteristic of noise resulting from its operation that is audible at noise-affected premises.
- Operating equipment and handle materials so as to minimise impact noise.
- Using off-site or other alternative processes that eliminate or lessen resulting noise.

4.1.3 Occupational Health, Safety and Welfare regulations

The South Australian *Occupational Health, Safety and Welfare Regulations* (2010, amended January 2011) specify an $L_{Aeq,8hr}$ noise level of 85 dB(A) as the limit above which hearing protection is required.

While this noise level is the equivalent level averaged over eight hours, it is desirable that no noise-sensitive receivers located nearby construction activities are exposed to continuous sound pressure levels (L_p) in excess of 85 dB(A).

4.1.4 Summary

Noise criteria applicable to the construction of the Hillside Mine and port facility are summarised in Table 8.

Table 8 Summary of noise criteria

Time period	Noise criteria level at noise-sensitive receivers
On a Sunday or other public holiday, and on any other day except between 7.00am and 7.00pm[1]	$L_{Aeq,15min}$ 45 dB(A)[2] L_{Amax} 60 dB(A)[2]
At all times	L_p 85 dB(A)

Note:

(1) A particular operation may occur on a Sunday or public holiday between 9.00am and 7.00pm, or may commence before 7.00am on any other day to avoid an unreasonable interruption of vehicle or pedestrian traffic movement or if other grounds exist that the Environment Protection Authority or other administering agency determines to be sufficient.

(2) Construction activity does not result in noise with an adverse impact on amenity if $L_{Aeq,15min}$ or L_{Amax} ambient noise levels at the noise-affected premises exceed the criteria levels, or if the frequency of maximum source noise levels (L_{Amax}) consistently exceeds frequency of occurrence of the maximum ambient noise level (L_{Amax})

4.2 Vibration

4.2.1 Overview

The effects of ground vibration resulting from construction activities may be segregated into the following three categories:

- human exposure – disturbance to building occupants: vibration which inconveniences or possibly disturbs the occupants or users of the building
- effects on building contents – vibration which may affect the building contents
- effects on building structures – vibration which may compromise the integrity of the building or structure itself.

In general, vibration criteria for human disturbance are more stringent than vibration criteria for effects on building contents and building structural damage. Hence, compliance with the more stringent limits dictated by human exposure will ensure that compliance is also achieved for the other two categories.

However, construction work is typically assessed against the structural damage standards as, in some cases, compliance with human disturbance criteria may not be practical. Adjustments to the criteria are warranted in these circumstances, as undue restriction on vibration levels may prolong operations and result in greater annoyance. The human disturbance vibration criteria have been presented as targets only with the structural damage criteria representing the levels that should not be exceeded.

4.2.2 Human disturbance goals

Table 9 gives an indication of typical human perception of vibration in the range from 8 to 80 Hz, which represents the typical range of construction vibration.

Table 9 Vibration and human perception of motion, 8 to 80 Hz

Approximate PPV vibration level, mm/s	Degree of perception
0.1	Not felt
0.15	Threshold of perception
0.35	Barely noticeable
1.0	Noticeable
2.2	Easily noticeable
6.0	Strongly noticeable

Source: German Standard DIN 4150-1975, *Part 2 – Structural vibration – Human exposure to vibration in building*

Australian Standard AS 2670.2–1990, *Evaluation of human exposure to whole-body vibration*, *Part 2: Continuous and shock induced vibration in buildings* provides vibration criteria for buildings, primarily with respect to annoyance of humans subjected to the building vibration. The vibration criteria are presented as one-third octave, root-mean-squared (RMS) acceleration and velocity base curves. Multipliers are then applied to the base curves depending on the sensitivity of the receiver space. Separate curves are also presented for the vertical, horizontal and combined directions. For this assessment, only the combined direction has been considered; this represents a conservative assessment as the combined direction takes the lower criteria of the vertical and horizontal directions for each one-third octave centre frequency band.

As construction vibration is often measured as a peak particle velocity (PPV) rather than RMS velocity (or acceleration), the velocity base curves have been converted to PPV by multiplying the RMS values by $\sqrt{2}$. The vibration criteria multipliers that have been used for the assessment are in accordance with Annex A of Australian Standard AS 2670.2, and based on continuous or intermittent vibration (vibration criteria curves presented in Figure 6).

- a multiplier of 1.0 has been used for residential receivers at night time
- a multiplier of 4.0 has been used for residential receivers during the day time.

Furthermore, construction vibration is also typically assessed (and monitored) as an overall vibration level rather than against frequency dependant criteria, therefore the one-third octave levels between 8 and 80 Hz have been considered individually as well as summed to provide an acceptable range and presented in Table 10.

Table 10 Building vibration combined direction (x,y,z) vibration criteria in mm/s (PPV)

Type of building occupancy	Human annoyance vibration criterion
Residential – Night	0.2 - 0.7
Residential – Day	0.6 - 1.9

It should be noted that where the measured PPV levels exceed the indicative levels in Table 10, it does not necessarily mean that the human disturbance goals have been exceeded. If this occurs, comparison should be made with the curves provided in Figure 6 or AS 2670.2 to determine whether an exceedance has actually occurred.

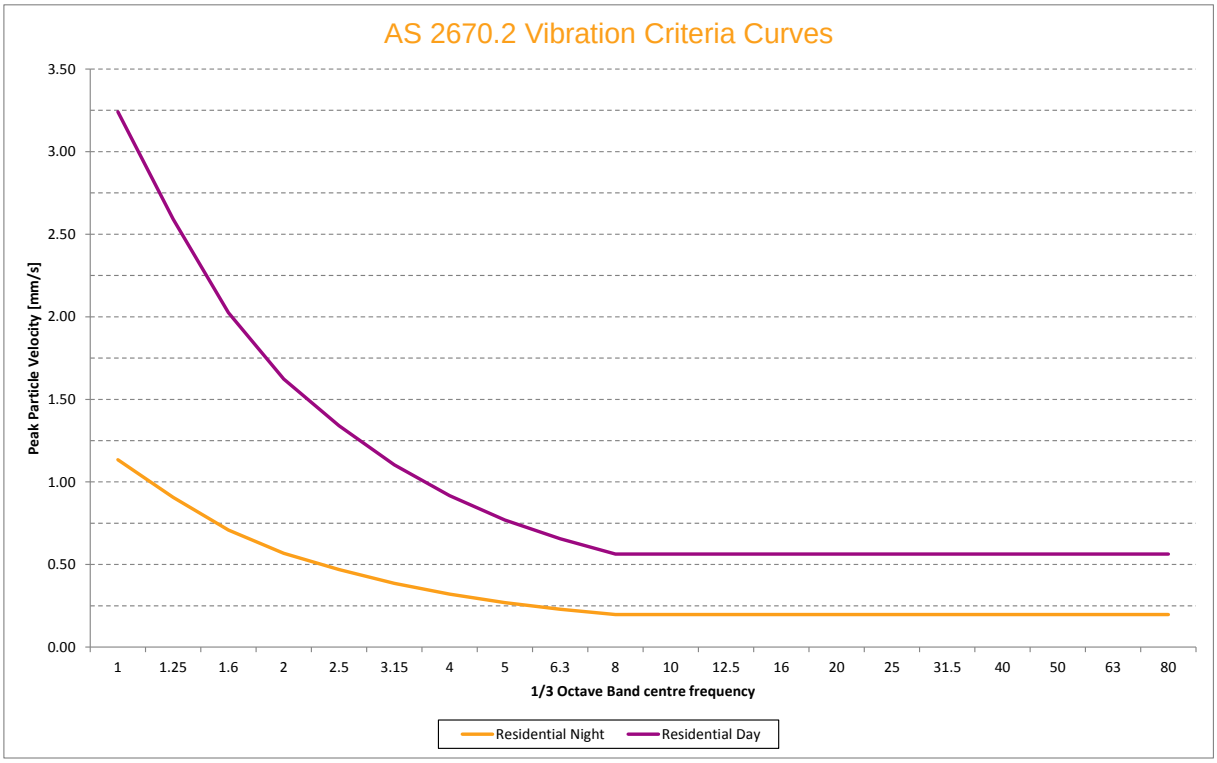

Figure 6 AS 2670.2 vibration criteria curves for residential receivers

Where works are expected to cause vibration levels in excess of the human exposure criteria, affected residents should be notified in advance.

4.2.3 Structural damage criteria

German Standard DIN 4150-1999 – Part 3, *Structural vibration in buildings – Effects on structures* (DIN 4150) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration, and is widely used in Australia. The DIN 4150 criteria are maximum levels measured in any direction at the foundation, or, maximum levels measured in (x) or (y) horizontal directions, in the plane of the uppermost floor, and are summarised in Table 11. The maximum levels are referred to as peak particle velocities (PPV).

Table 11 Structural damage 'safe limits' for construction vibration at structures

Group	Type of structure	Vibration velocity (PPV) in mm/s		
		At foundation at a frequency of(1)		
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. heritage-listed)	3	3 to 8	8 to 10

Note:

(1) For frequencies above 100 Hz, the higher values in the 50 Hz to 100 Hz column should be used.

The DIN 4150 criteria levels are 'safe limits' up to which no damage due to vibration effects has been observed for the particular class of building.

'Damage' is defined by DIN 4150 to include even minor non-structural effects such as superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls

from load bearing walls. DIN 4150 states that when vibrations higher than the ‘safe limits’ are present, it does not necessarily follow that damage will occur.

4.2.4 Summary

Sections 4.2.2 and 4.2.3 demonstrate that there is a significant difference between the level of vibration at which residents will start to be disturbed and the level at which the risk of structural damage will arise.

For the construction phase of the Hillside Mine and port facility, it is recommended that:

- the human disturbance criteria presented in Table 10 are adopted as vibration targets, where all reasonable and practicable mitigation measures will be considered
- the structural damage criteria presented in Table 11 are adopted as vibration limits.

5.0 Noise and vibration assessment

5.1 Noise

5.1.1 Mine construction sources

Rex Minerals have advised that typical significant noise generating items of plant during the construction of the mine site would be expected to include:

Processing plant

- Air compressors
- Diesel welding machines
- Generators
- Scabblers (Triple-head)
- Plate compactors
- Vertical rammers
- Backhoes
- Graders
- Water carts
- Bulldozers
- Excavators
- Vibratory rollers – smooth and padfoot drum
- Front-end loaders
- Six-wheel tip trucks
- Cranes
- Elevated Work Platform - Boom lift

Mine pit

- Graders
- Water carts
- Bulldozers
- Excavators
- Front-end loaders

5.1.2 Port construction sources

Significant noise generating items of plant and activities for the construction of the port facility would be expected to include:

- Air compressors
- Diesel welding machines
- Generators
- Excavators
- Semi-trailer and prime mover
- Cranes
- Work boat (Bollard pull tug)

- Elevated Work Platform (Boom lift)
- Safety boat

5.1.3 Pipeline construction sources

Significant noise generating items of plant and activities for the construction of the pipeline would be expected to include:

- Air compressors
- Diesel welding machines
- Generators
- Excavators
- Cranes
- Six-wheel tip trucks

5.1.4 Road construction sources

Significant noise generating items of plant and activities for the construction of roads would be expected to include:

- Vibratory rollers
- Excavators
- Graders
- Water carts
- Front-end loaders
- Six-wheel tip trucks

5.1.5 Indicative noise levels

Plant[1]	$L_{eq,15min}$ at specified distance				L_{max} at specified distance				Data source
	500 m	750 m	1,000 m	2,000 m	500 m	750 m	1,000 m	2,000 m	
Air compressor	45	41	39	33	47	43	41	35	Glenelg tram overpass project
Backhoe	45	41	39	33	53	49	47	41	AECOM in-house database
Boom lift EWP	38	34	32	26	52	48	46	40	Adelaide Oval grandstand demolition project
Bulldozer	46	42	40	34	54	50	48	42	AS 2436[2]
Crane 16T	46	42	40	34	51	47	45	39	F3 Freeway project
Crane 200T	55	51	49	43	63	59	57	51	Airport link project
Crane 50T	51	47	45	39	56	52	50	44	Airport link project
Excavator 15T	42	38	36	30	50	46	44	38	Rail revitalisation project
Excavator 25T	45	41	39	33	53	49	47	41	Rail revitalisation project
Excavator 35T	48	44	42	36	55	51	49	43	Rail revitalisation project
Front-end loader	51	47	45	39	58	54	52	48	AECOM in-house database
Generator	43	39	37	31	46	42	40	34	Rail revitalisation project
Grader	48	44	42	36	56	52	50	44	AECOM in-house database
Plate compactor	39	35	33	27	42	38	36	30	AECOM in-house database
Safety boat	42	38	36	30	45	41	39	33	AECOM in-house database

Plant[1]	$L_{eq,15min}$ at specified distance				L_{max} at specified distance				Data source
	500 m	750 m	1,000 m	2,000 m	500 m	750 m	1,000 m	2,000 m	
Truck - flat bed	46	42	40	34	53	49	47	41	AECOM in-house database
Truck - semi-trailer	46	42	40	34	53	49	47	41	AECOM in-house database
Truck - six wheel tipper	45	41	39	33	52	48	46	40	AECOM in-house database
Tug-boat	57	53	51	45	63	59	57	51	AECOM in-house database
Vertical rammer	51	47	45	39	54	50	48	42	AS 2436[2]
Vibratory roller padfoot drum 10T	55	51	49	43	59	55	53	47	AECOM in-house database
Vibratory roller smooth drum 10T	50	46	44	38	54	50	48	42	AECOM in-house database
Vibratory roller smooth drum 6T	43	39	37	31	47	43	41	35	Pt Wakefield Road upgrade project
Water cart	45	41	39	33	52	48	46	40	AECOM in-house database
Welding machine - Diesel	43	39	37	31	46	42	40	34	AS 2436[2]

Note:

1) Indicative noise levels assume that no non-standard noise mitigation measures have been applied to the equipment.

2) Australian Standard AS 2436-2010 – *Guide to noise and vibration control on construction, demolition and maintenance sites*

5.1.6 Comparison with measured pre-construction noise levels

Table 12 provides indicative noise levels at locations where pre-construction noise monitoring was undertaken, as identified in Section 3.1. Indicative noise levels are provided for the most significant noise generating items of plant for the construction of the port facility, pipeline, mine site, and road diversion. Indicative noise levels have been compared to measured pre-construction noise levels at night-time as this represents the time when the background noise levels are lowest and complaints are most likely to occur. Note that these indicative noise levels do not account for any shielding provided by barriers or terrain features on site and assume plant is located on the closest construction site location to the receptors, and will therefore provide a conservative estimation of noise levels.

Indicative noise levels exceeding the 45 dB(A) night-time construction noise criterion are shown in bold text.

Table 12 Predicted noise levels at pre-construction noise monitoring locations, dB(A)

Port facility					
Location [distance from site]	50T Crane	Generator	Welding machine	Tug boat	Median pre-construction night time noise level
Location 1 [1200 m]	43	35	35	**49**	42
Location 2 [1000 m]	**46**	38	38	**51**	36

Pipeline					
Location [distance from site]	**50T Crane**	**Generator**	**Welding machine**	**25T Excavator**	**Median pre-construction night time noise level**
Location 2 [500 m]	**51**	43	43	45	36
Location 3 [950 m]	45	37	37	39	39
Location 4 [550 m]	**50**	42	42	44	41
Mine site – processing plant					
Location [distance from site]	**35T Excavator**	**10T Vibratory roller (padfoot drum)**	**200T Crane**	**Bulldozer**	**Median pre-construction night time noise level**
Location 4 [3600 m]	31	38	38	29	41
Location 5 [2200 m]	35	42	42	33	35
Mine site – pit					
Location [distance from site]	**35T Excavator**	**Front-end loader**	**Grader**	**Bulldozer**	**Median pre-construction night time noise level**
Location 6 [800 m]	44	**47**	44	42	37
Location 7 [1500 m]	38	41	38	36	34
Road realignment					
Location [distance from site]	**10T Vibratory roller (padfoot drum)**	**10T Vibratory roller (smooth drum)**	**Grader**	**15T Excavator**	**Median pre-construction night time noise level**
Location 6 [300 m]	**59**	**54**	**52**	**46**	37
Location 7 [750 m]	**51**	**46**	44	38	34

Noise from several items of plant are likely to cause exceedances of the 45 dB(A) night-time construction noise criterion when sited at the closest locations to noise receptors. However, we understand that only construction at the mine site is proposed to occur on a 24 hour basis.

The Noise EPP construction noise criteria are based upon external noise levels. In order to provide an objective measure of likely noise impact on sleeping areas, we have predicted internal noise levels and provided comparison to recommended interior noise levels for sleeping areas provided by *AS/NZS 2107:2000 – Acoustics-Recommended design sound levels and reverberation times for building interiors* (AS 2107).

For our internal noise level predictions we have assumed BCA compliant dwelling constructions with windows partially open (15 dB transmission loss between outside and inside).

AS 2107 provides a maximum recommended internal noise level of 35 dB(A) for sleeping areas in houses near minor roads. We adopted the AS 2107 criterion for minor roads because of the low background noise level at receptors in the vicinity of St Vincent Highway suggests the lower level is more appropriate for internal noise levels.

There are no receptors in the vicinity of the mine site where predicted internal noise levels exceed 35 dB(A).

Night-time construction works may be required in some instances to expedite the construction process and thus minimise adverse reaction from the community. Should night-time construction activity be required in other areas

outside of the mine site, it is suggested that where possible operation of plant that is predicted to exceed the construction noise criterion is ceased by 10pm in order to minimise the potential for adverse reaction.

Since there are no predicted exceedances of the internal noise level criterion for the mine site construction, it is suggested that routine monitoring of construction noise is not warranted.

It is important to note that compliance with construction noise criteria does not imply that construction noise will be inaudible at the receptor locations.

5.2 Vibration

The relationship between vibration and the probability of causing human annoyance or damage to structures is complex. This complexity is mostly due to the magnitude of the vibration source, the particular ground conditions between the source and receiver, foundation-to-footing interaction and the large range of structures that exist (and vary in dimensions, materials, type and quality of construction and footing conditions). The intensity, duration, frequency and number of occurrences of vibration all play an important role in both the annoyances caused and the strains induced in structures.

The pattern of vibration radiation depends on a range of factors, but the potential for vibration to cause disturbance to residents, or structural damage to buildings, is still largely dependent on the distance between the vibration generator and the receiver.

5.2.1 Vibration sources

The major source of ground vibration during the construction phase of the Hillside mine is likely to occur from road construction works in the vicinity of residential structures. The large setback distances between the mine, pipeline and port facility construction and the nearest vibration sensitive receivers means that construction vibration from activities on these sites is not likely to be perceptible at the nearest vibration sensitive receivers.

5.2.2 Predicted vibration levels

Table 13 provides approximate vibration levels that may be expected for various road construction vibration sources based on previous measurement experience on other projects. Other plant and equipment on site may cause perceptible vibration from time to time, but the vibration levels from such plant would be expected to be no higher than that caused by heavy vehicle traffic.

Table 13 Approximate generated vibration levels for various sources

Activity	Typical PPV levels of ground vibration
Vibratory rollers	Typically between 3 to 5 mm/s at distances of 5 to 10 metres from the roller. Up to 1.5 mm/s at distances of 25 m. No damage would be expected for any standard residential building at distances greater than approximately 12 m (for a medium to heavy roller).
Excavators	Less than 2 mm/s at distances greater than 10 m. Typically less than 0.2 mm/s at distances greater than 40 m.
Heavy vehicle traffic (over normal road surfaces)	0.01–0.2 mm/s at the footings of buildings located 10–20 m from a roadway.
Heavy vehicle (over irregular surfaces)	0.1–2.0 mm/s at the footings of buildings located 10–20 m from a roadway.

As identified in Section 3.0, the nearest vibration sensitive receivers to the road diversion works are located 100 m to the South of the alignment. This separation distance suggests that it is unlikely that there will be any perceived vibration due to the road construction works.

6.0 Noise and vibration management

6.1 Community consultation

The local community may raise concerns regarding noise and vibration from mine construction works as the project progresses. To minimise community concerns, effective community consultation is essential.

Rex Minerals will be responsible for ongoing consultation with residents during the project. Rex Minerals will liaise with the local community regarding:

- programmed times and locations of construction work, particularly those activities that may generate noise and vibration
- noise and vibration monitoring results, where required
- noise and vibration mitigation measures being implemented on site.

6.1.1 Complaint management procedure

Rex Minerals will maintain a project hotline to receive any complaints. Rex Minerals will nominate a person to assist with complaints resolution who will be appropriately trained in community consultation and have the ability to action the complaint.

A complaint management procedure will be implemented for complaints relating to noise and vibration, including the following processes:

1) Receive complaint and record details in a complaint log.
2) Assess whether the issue can be resolved easily and take immediate action if possible.
3) If not, assess the construction activities and determine whether there is any reason to believe the exposure of receivers is higher than anticipated.
4) Undertake monitoring of noise or vibration where appropriate and review the levels in light of the noise and vibration targets.
5) If monitoring indicates noise and vibration levels exceed relevant targets, implement all reasonable and practicable mitigation measures.
6) Advise complainant of actions undertaken.

6.2 Noise monitoring

Monitoring of construction noise levels shall be undertaken in response to a complaint where this is considered an appropriate response.

The following procedures will be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

6.2.1 Plant and equipment noise

Monitoring of significant plant and equipment noise will be undertaken as necessary to assess compliance with expected noise emission levels. The results should be compared to standard values for that type of equipment. If the equipment is suspected as being significantly louder than the standard values, the equipment will be stood down and necessary action taken.

Any significant plant items will be tested in typical site conditions. A suitable procedure may be according to the method of Australian Standard AS 2012.1 *Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition*.

6.2.2 Construction noise

Where noise monitoring is occurring due to works adjacent critical sensitive receiver locations or in response to a complaint, the monitoring will be undertaken at the nearest relevant sensitive receiver. If monitoring is not able to be undertaken at the receiver, a suitable representative location will be selected.

Noise monitoring will be undertaken in accordance with *Part 3—Measurement procedure* of the *Environment Protection (Noise) Policy 2007*.

Where the noise monitoring is conducted within 3.5 metres of large walls or a building facade, then a reflection correction of up to -2.5 dB(A) will be applied to remove the effect of increased noise due to sound reflections from such structures.

The monitoring results will be analysed to determine if there is any adjustment required to the extent of noise mitigation.

6.2.3 General noise monitoring procedure

All sound level meters used will be minimum Class 2 instruments as described in Australian Standard AS IEC 61672.1-2004 *Electroacoustics – Sound level meters - Specifications* and will have been calibrated in the previous 24 months by a National Association of Testing Australia registered laboratory. The calibration of the meters will be checked in the field before and after the noise measurement period.

6.3 Vibration monitoring

Monitoring of construction vibration levels will be undertaken in response to a complaint where this is considered an appropriate response.

Vibration monitoring will be conducted using tri-axial geophones measuring over a frequency range from 1 to 500 Hz, in accordance with DIN 4150. Monitors will be placed at the building foundation of the nearest sensitive receiver to the construction activity being monitored.

Where structural damage criteria are exceeded, alternative construction processes will be investigated and/or dilapidation surveys undertaken prior to and after the construction work at affected structures.

6.4 Noise and vibration mitigation

This section outlines noise and vibration mitigation measures to be implemented as part of the construction works. It should be noted that it may not be feasible to adopt all of the mitigation measures at all times and identification of all reasonable and practicable mitigation methods will be conducted by the site supervisor and/or other nominated representative on a regular basis during noisy works.

In relation to the implementation of mitigation measures, practicability addresses engineering consideration regarding what is practical to build. Reasonableness relates to the application of judgment in arriving at a decision, taking into account the following factors:

- noise or vibration reduction achieved
- number of people benefited
- cost of the mitigation measure
- delay to schedule and whether the measure will prolong exposure to noise/vibration
- pre-construction noise and vibration levels at receivers
- time of day of construction.

While the measures presented will not necessarily result in mitigating all noise and vibration impacts at all times, they should serve to reduce impacts to levels most sensitive receivers should find acceptable.

6.4.1 Worksite training

Worksite induction training implemented on site will include a section educating staff on noise and vibration sensitive issues, and the need to make as little noise as possible. Workers will be advised to avoid shouting and whistling. Discussions will also be held with truck drivers to emphasise the requirement to travel at low speed along uneven corridors near sensitive receivers, to minimise the noise and vibration impacts.

‘Toolbox talks’ will be held at regular intervals and before any night works with workers, including discussion of noise and vibration issues and appropriate on-site behaviour.

6.4.2 Mitigation of construction noise impacts

Pro-active noise control strategies to minimise noise during construction may include enclosures, silencers or the substitution of alternative construction processes. Identification of all reasonable and feasible noise mitigation

methods will be conducted by the site supervisor and/or other nominated representative on a regular basis during noisy works and any night works that may occur. The site supervisor will have the authority to modify work practices in response to complaints, where this is considered appropriate.

Noise level emissions and potential annoyance depend significantly on the condition of the equipment, the type of operation, its duration and the time of day it is conducted. All major items of plant will be checked for noisy operation at the commencement of works on site and following a major service.

Acoustic enclosures of generators, lighting generators and compressors

Where noisy plant is to be fixed in a stationary location such that it may impact on sensitive receivers for a significant length of time (e.g. generator located in lay down area for the duration of the project), an acoustic enclosure will be installed where practical.

Acoustic enclosures will be made of minimum 6 mm thick plywood or acoustic equivalent, and lined with 50 mm thick sound absorption material. Reference will be made to Australian Standard AS 2436-2010 for practical examples on how to build an effective acoustic enclosure.

Acoustic screening of noisy construction activities

In certain situations, acoustic screens may be erected adjacent to the works or receivers to screen noise sensitive receivers. For maximum effectiveness, the barrier should be brought as close as possible to either the noise source or receiving location. Care should be taken to ensure that a barrier does not transfer a problem from one receiver to another by reflecting noise.

An acoustic screen should be constructed from a solid material weighing at least 10 kg/m^2 and constructed to a height of at least 2.1 metres. The screen should have no air gaps or openings at joints. With short straight barriers some sound will pass around the ends. As a rule of thumb the length of the barrier should be at least 10 times greater than its height for a stationary noise source. If a shorter barrier has to be used, it is better to bend the barrier around the noise source.

The site supervisor shall also consider buildings and other shielding features (e.g. hoarding and material stockpiles) to an advantage in terms of increased shielding where possible.

Site management

Site management will include the following:

- location of site access roads and site compounds as far from sensitive receivers as possible
- location of noisy plant as far away from noise sensitive receptors as possible whilst still allowing efficient and safe completion of the work
- care will be taken not to drop materials to cause peak noise events, including from a height into a truck
- plant known to emit noise strongly in one direction will be orientated so that the noise is directed away from noise sensitive areas
- machines that are used intermittently will be shut down in the intervening periods between works or throttled down to a minimum
- the reversing of vehicles will be minimised to reduce the noise from reversing signals
- truck operators will ensure that tailgates are cleared and locked at the point of unloading
- vehicle warning devices such as horns will not be used as signalling devices
- two way radios will be used at the minimum effective volume
- equipment will be located to take advantage of the barriers provided by existing site features and structures
- when work is complete, the noise of packing up plant and equipment and departing from the site will be minimised.

Equipment management

Equipment management will include the following:

- selection of low-noise plant and equipment
- equipment will have quality mufflers installed
- equipment will be well maintained and fitted with adequately maintained silencers which meet the design specifications

- silencers and enclosures will be kept intact, rotating plants will be balanced, loose bolts tightened, frictional noise reduced through lubrication and cutting noise reduced by keeping equipment sharp
- equipment not in use will be shut down
- only necessary power will be used to complete the task
- only necessary equipment will be on site
- traffic practice controllers will be used to prevent vehicles and equipment queuing, idling or reversing near noise sensitive receivers.

Lay down area management

In addition to the mitigation measures discussed in previous sections, noise mitigation for the lay down areas will include the following:

- operation in the lay down areas will be minimised after the evening period
- site access roads and routes will be selected and located as far away from noise sensitive receivers as possible
- operations in the lay down areas will be conducted as far from the nearest sensitive receivers as possible and will utilise shielding from any site features
- truck movements to and from the lay down areas will be restricted to low speed.

Night works management

In addition to the mitigation measures discussed in previous sections, noise mitigation for night time works will include the following:

- Scheduling noisy activities into the permissible time of use period wherever possible
- Scheduling noisy works that must occur at night prior to 10pm where feasible
- Consideration of programming of night works to limit the number of consecutive nights that works will occur to provide respite
- Installation of temporary noise barriers around the night work areas or for adjacent sensitive receivers (such as installation of temporary plywood covers over windows for night works).

6.4.3 Mitigation of vibration impacts

Identification of all reasonable and practicable vibration mitigation methods shall be conducted by the site supervisor and/or other nominated representative on a regular basis for works that are likely to produce perceptible vibration levels at sensitive receivers.

The following site and equipment management processes will be undertaken, where practicable, to mitigate vibration impacts:

- all plant will be properly maintained
- low vibration alternatives for plant and processes will be implemented where possible
- plant that has high and low vibration operating settings will be run on the lowest possible vibration setting
- truck movements along uneven surfaces will be restricted to low speed.

6.4.4 Mitigation measures in context

The above mitigation measures will not necessarily result in removing all noise and vibration impacts resulting from construction works. However, they should assist in reducing noise and vibration impacts to levels that most sensitive receivers should find acceptable.

Overall, the construction noise and vibration impact of the project can most effectively be reduced by completing the project as efficiently as possible. Clear communications to all affected receptors of the envisaged duration and times of operation will help alleviate the “surprise” and “when is it going to stop” concerns.

7.0 References

The following documents have been referenced in developing this CNVMP:

- Australian Standard AS 2012.1-1990, *Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition*.
- Australian Standard AS 2187.2-2006, *Explosives—Storage and use, Part 2: Use of explosives.*
- Australian Standard AS 2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites.*
- Australian Standard AS 2670.2-1990, *Evaluation of human exposure to whole-body vibration, Part 2: Continuous and shock induced vibration in buildings*.
- Australian Standard AS IEC 61672.1-2004, *Electroacoustics – Sound level meters – Specifications*.
- British Standard BS 5228-1:2009, *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*.
- German Standard DIN 4150-1975, *Part 2 – Structural vibration – Human exposure to vibration in buildings.*
- German Standard DIN 4150-1999, *Part 3 – Structural vibration – Effects of vibration on structures*.
- Richards A.B., Moore A.J., 1997, *Blasting in an Urban Environment,* The AusIMM Annual Conference, Ballarat, 12 – 15 March 1997
- SA EPA, 1993, *Environment Protection Act 1993*.
- SA EPA, 2007, *Environment Protection (Noise) Policy 2007*.
- SA EPA, 2009, Guidelines *for the use of the Environment Protection (Noise) Policy 2007*.

Hillside Mine
Blasting Impact Assessment

8th March 2013

Prepared for:

Rex Minerals

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EXECUTIVE SUMMARY

The Hillside Project comprises an iron-oxide copper gold deposit located to the west of Adelaide on the eastern side of Yorke Peninsula, approximately 12 kilometres south southwest of Ardrossan. The main mineralisation zone is hosted by a folded sequence of intensely altered metasediments and skarns which have been intruded by micro-granite and micro-diorite volcanics. Rex Minerals propose to establish an initial open pit mine with a future underground operation design to access the deeper reserves.

As part of the feasibility assessment, Saros (Australia) Pty Ltd has been engaged by Rex Minerals to investigate the effects of both the open pit and underground blasting activities and detail mitigation measures to achieve compliance with licence conditions. The focus of this study is on ground vibration and air overpressure effects from blasting activities and safety measures in relation to flyrock.

Compliance criteria for ground vibration and air overpressure impacts have been based on guidelines detailed in Australian Standard 2187.2 - 2006. The guidelines are designed to limit human discomfort at a sensitive site based on long term blasting activities and recommend the following:

- *Ground Vibration - 5mm/s for 95% blasts per year, with a 10mm/s maximum unless agreement is reached with the occupier that a higher limit may apply; and*
- *Air Overpressure – 115dBL for 95% blasts per year, with a 120dBL maximum unless agreement is reached with the occupier that a higher limit may apply.*

Mining within the open pit will be conducted on 10 metre benches with the initial geotechnical investigations indicating mechanical excavation can be achieved to a depth of around 80 metres below the surface. Below this, drill and blast practices will be utilised with designs based on a 229 millimetre blastholes.

Access to the underground working will be via declines with portals located at both the northern and southern ends of the open pit. From the declines a series of horizontal sublevel access drives will be developed into the mineralisation zone providing access to the ore. Underground mining will likely involve a combination of uphole and bench stoping utilising 102 millimetre diameter blastholes between horizontal sublevels spaced at 25 metres.

Based on the modelling of ground vibration and air overpressure impacts, the proposed blasting practices conducted on a 10 metre bench with 229 millimetre blasthole can be successfully utilised throughout the pit. Good controls over the movement of free faces and initiation timing will be required to ensure blasting activities in order to maintain compliance with overpressure limits. The modelling also indicates that blasting from underground activities will induce lower vibration levels than the surface blasting.

During the initial phase of the mining operations blasting will be minimal but will ramp up over time. It is planned that both the open pit and underground mining will be fully operation around Year 7 of the project, at which point disturbance from blasting activities will only equate to a few seconds each day.

It is important to note that regulatory compliance limits are based on human comfort levels rather than damage thresholds. As a result, compliance with the licence

conditions will minimise human discomfort and prevent any likelihood of damage to neighbouring structures.

With a key focus on safety for both personnel and infrastructure, best practice blasting should see rock displacement controlled to within the blast area. Strict controls over the design and implementation of blasting activities are critical for both safety and the control of environmental impacts. Modified practices relating to both blast design and implementation of loading practices will be required on the eastern edge of the pit and should be conducted in accordance with the Drill and Blast Management Plan.

Accurate blast design and monitoring records must be maintained and documented for future reference. The blast management team should review results following each blast, with continued improvement of blasting practices.

CONTENTS

1. BACKGROUND

Rex Minerals Hillside Project is an iron-oxide copper gold deposit located on the east coast of the Yorke Peninsula in South Australia. The proposed mining of the deposit includes an initial open pit with future underground workings planned to win the deeper reserves. Whilst the available geotechnical information indicates the material close to the surface can be free dug, the use of drill and blast activities is anticipated as the mine progresses deeper.

Saros (Australia) Pty Ltd (Saros) has been commissioned to assess the effects of both the open and underground blasting activities and detail mitigation measures to achieve compliance with licence conditions. The focus of this study is on ground vibration and air overpressure effects from blasting activities and safety measures in relation to flyrock.

The information contained in this report has been based on the details and plans provided by Rex Minerals to Saros for review including the Drill and Blast Management Plan. Modelling of blasting impacts has been based on data obtained from mining and blasting operations which possess comparable geological and topographic conditions and utilise similar scale blasting practices.

1.1 Scope of Work

In order to assess the likely impacts of proposed blasting activities, the study will be focused on the following:

- Assessment of appropriate blasting compliance limits in accordance with regulatory requirements and Australian Standards;
- Identification of sensitive receptors and assessment of appropriate limits;
- Review of proposed blast design, benching configurations and geological setting;
- Determination of appropriate predictive models;
- Modelling of impacts from proposed blasting activities;
- Contouring of vibration and air overpressure impacts from blasting activities;
- Recommendations of blast design criteria based on compliance with environmental criteria imposed on the mining operation;
- Flyrock mitigation and safety measures; and
- Provide background information into human sensitivity and structural stability with specific respect to ground vibration levels and air overpressure.

1.2 Site Description

The Hillside Project is located to the west of Adelaide on the eastern side of Yorke Peninsula, approximately 12 kilometres south southwest of Ardrossan. The region is predominantly large rural lots with a relatively flat topographic profile. The St Vincent Gulf coastline is 600 metres to the east of the site boundary.

The open pit is located on the eastern side of the lease (adjacent to the current alignment of the St Vincent Highway) with the integrated tailing and spoil to the west

and the processing plant to the north. The proposed underground workings are located directly beneath the open pit.

1.3 Geological Setting

The Hillside Deposit is hosted by a folded sequence of intensely altered metasediments and skarns. These have been intruded by micro-granite and micro-diorite volcanics within the main mineralisation zone. The deposit is bordered by the Pine Point Fault to the west and a large granitic intrusion to the east. The ore body is steeply dipping and runs in a north northeast orientation. As a result the geology within the proposed pit is varied with rock types including:

- Carbonates;
- Gabbro;
- Breccia;
- Skarn;
- Granite;
- Metasediments; and
- Saprock.

The initial geotechnical investigations indicate that around the top 80 metres of the material can be won through mechanical methods. Below this level it is anticipated the use of drill and blast practices will be required. The variability in the geology and rock strengths will be an important factor in the planning and design of blasting practices.

2. COMPLIANCE CONDITIONS

The requirements detailed in Australian Standard AS2187.2[1] relate to the use of explosives, and consequently also addresses both blasting activities and their subsequent environmental effects. The provisions pertaining to ground vibration and air overpressure have commonly formed the basis for compliance limits imposed on blasting activities within Australia. For the purposes of this investigation, we have utilised the recommended vibration and air overpressure limits which relate to minimising human discomfort at a sensitive site for long term blasting operations, as summarised in Table 1.

[1] AS 2187.2 – 2006, Australian Standard, *"Explosives-Storage, transport and use Part 2: Use of explosives"*

Category	Type of Blasting Operations	Parameter	Peaks Level
Sensitive Site*	Operations lasting longer than 12 months or more than 20 blasts	Ground Vibration	5mm/s for 95% blasts per year, 10mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Sensitive Site*	Operations lasting longer than 12 months or more than 20 blasts	Air Overpressure	115dBL for 95% blasts per year, 120dBL maximum unless agreement is reached with the occupier that a higher limit may apply
**A sensitive site includes houses and low residential buildings, hospitals, theatres, schools etc, occupied by people*			

Table 1: *Summary of Ground Vibration and Air Overpressure limits to minimise human discomfort from long term blasting activities at a sensitive site (Adapted from Tables J4.5(A) and J5.4(A) – AS2187.2 -2006*

There has been extensive international research into the effects of blast vibration and overpressure on both personal amenity and the potential for structural damage. The limits detailed in Table 1 are based on minimising human discomfort and are well below the levels likely to produce structural damage. These human comfort levels generally form the basis of compliance criteria for long term blasting activities.

With respect to potential for damage of commercial structures, the recommended limits relate to the *British Standard 7385-2 1993* guidelines which are based on the type of structure and the frequency of the peak particle velocity and has been adopted by AS2187.2. The chart presented in *Figure 1 - BS7385-2 Transient Vibration Guide Values for Cosmetic Damage* details guide values for the prevention of minor or cosmetic damage to structures.

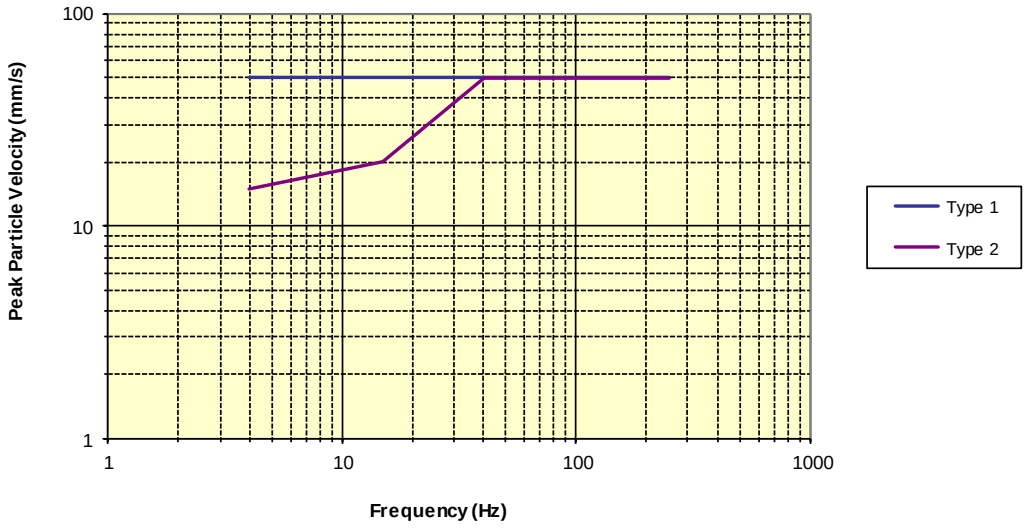


Figure 1*: BS7385-2 Transient Vibration Guide Values for Cosmetic Damage*

The Type 1 structures relate to reinforced or commercial structures, whilst Type 2 is representative of unreinforced or residential buildings. For frequencies between 4Hz and 40Hz, guide values are reduced for Type 2 structures taking into account the higher strains induced by lower frequency vibration of the same magnitude.

Transport infrastructure including roads and railway lines are capable of sustaining much higher vibration levels. Vibration limits in the order of 100mm/s are commonly adopted to ensure a high factor of safety is maintained.

2.1 Sensitive Receptors

The Hillside Project is situated amongst rural properties with very low density of residential dwelling in close proximity to the mine. The closest sensitive receptor is the rural residence located 1.1 kilometres to the southwest of the pit. The closest township is the small community of Pine Point which is located on St Vincent Gulf approximately 2.4 kilometres to the south southeast of the pit. The locations of the proposed open pit and underground workings in relation to the neighbouring sensitive receptors are presented in *Figure 2 – Hillside Project – Open cut and underground operations*.

Given the location of the Hillside Deposit modifications to the surrounding infrastructure including the realignment of both the St Vincent Highway and Yorke Highway are also required.

3. PROPOSED BLASTING PRACTICES

Mining activities to be undertaken at the Hillside Project can be divided into two distinct categories, which include open pit and underground mining. The mining methods vary significantly as do the associated blasting practices.

3.1 Open Pit Blasting

The open pit mining will be conducted on 10 metre benches. Given the current understanding of rock conditions and the scale of mining the proposed blast design parameters as per the Drill and Blast Management Plan are detailed in Table 2.

Hillside Project – Proposed Open Blast Design Parameters	
Parameter	*Type/Value*
Bench Height	10 metres
Burden	6.0 – 7.0 metres*
Spacing	5.0 – 6.0 metres*
Blasthole Diameter	229 millimetre
Stemming	3.5 metres
Subdrill	1.0 – 1.5 metres*
Explosive Type	ANFO/Bulk Emulsion*
Powder Factor	0.6 – 0.9 kg/m^3
Charge per Blasthole	Up to 350 kilograms
Initiation	Pyrotechnic
**Variability dependent on the rock strength and ground conditions*	

Table 2: *Proposed open pit blast design parameters for the Hillside Project*

Whilst the blasting activities have been based around a 229 millimetre blasthole, a range of burden, spacing and powder factors have been assumed given the variability in the ground conditions and rock strength.

3.2 Underground Blasting

The development of underground workings is not planned until the open pit is well established (around Year 6 into the project). Access to the underground mining operations will be via a series of portals located within the main pit at both the northern and southern ends. A decline will be developed from each portal working down to the base of the mine. The dimensions of the declines will range from 4.5 to 5.5 metre wide and 4.5 to 5.8 metres in height, and will be developed in 4.0 metre blast rounds. This will involve the use of small diameter blastholes. Based on a 45mm diameter blasthole, the charge per hole would be 4.7kilograms, assuming a 0.5 metre uncharged collar. Each blast would involve around 60 holes, with up to 5 holes fired on a single delay.

From the decline a series of horizontal sublevel access drives will be developed into the mineralisation zone providing access to the ore. The spacing between the sublevels will be 25 metres in vertical height. Longholes will then be drilled between sublevels with each row of holes termed a “ring”. Mining methods are likely to involve a combination of uphole and bench stoping. The use of 102 millimetre diameter blastholes is expected for the longholes, equating to a maximum charge weight per hole of 245kilograms.

4. ENVIRONMENTAL IMPACTS

The impacts of blasting activities detailed in this document relate specifically to that of ground vibration, air overpressure and flyrock. The following section discusses their controlling factors and details mitigation measures for future blasting activities. The predictive modelling of ground vibration and air overpressure impacts has been based on monitoring data obtained from mining and blasting operations which possess comparable geological and or topographic conditions and utilise similar scale blasting practices.

4.1 Ground Vibration

As the explosive detonates in a blasthole, the shock wave that is generated radiates from the source and will attenuate in both amplitude and frequency. The rate of this attenuation will vary depending on the ground conditions. Therefore, the level of ground vibration measured at any point from the blast will be dependent on a range of factors which include:

- The maximum explosive quantity per blast hole;
- The distance from the blast to the monitoring point;
- The geological conditions the vibration is required to pass through; and
- Confinement and coupling of the explosive.

Ground Vibration is measured in terms of velocity (mm/s). The most common method for the prediction of vibration levels from blasting is the scaled distance equation which relates the level of vibration to the maximum instantaneous charge weight and distance between the blast and the sensitive receiver. The ground

conditions will control the rate the vibration attenuates which can be determined for a given site.

In the absence of site-specific data, modelling has been based on a vibration attenuation equation developed from blasting activities conducted in similar geological conditions. The vibration equation based on a 95% confidence level has the following form:

$$PPV_{95\%} = 1905\left(\frac{R}{\sqrt{Q}}\right)^{-1.60}$$

Where *PPV* *peak particle velocity in millimetres/second;*

R *distance between source and point of measurement in metres;*

Q *effective charge weight per delay in kg.*

It should be noted that the predictions based on the 95 percentile are considered the upper limit, with the average levels likely to be around 50 percent lower.

4.1.1 Mitigation Measures for Controlling Ground Vibration

The critical factors with respect to the control of ground vibration are the amount of explosive detonated per delay and the distance from the blast to the sensitive receiver. Therefore, as blasting activities approach the neighbouring residences, a reduction in effective charge weights may be required. This can be achieved by various modifications to the blast design which can include:

- A reduced bench height or use of deck loading;
- A reduced blast hole diameter;
- Lower density explosive products;
- Downloading blast holes (decoupled charges); and
- The use of electronic detonators to provide greater flexibility and accuracy in initiation timing, minimising the likelihood of vibration enhancement from multiple blast holes.

Once explosive quantities have been determined for a specified blast, it is critical that accurate quantities be loaded into each blast hole and checked against the design plan. It is also important that the initiation sequence be designed to ensure there is adequate delay between blastholes, minimising the effect of vibration enhancement and reducing peak levels. In recent years, the use of electronic detonators has become more prevalent. This initiation method allows for greater flexibility and accuracy over initiation timing providing greater control.

4.2 Air Overpressure

Air overpressure relates to the air borne vibration produced from the blast. It is less affected by the charge weight and geological conditions, but is significantly influenced by the following factors:

- The degree of explosive confinement;
- Topographic relief;
- Orientation of the blast;

- Initiation timing; and
- Atmospheric conditions.

Similar to vibration prediction, a scaled distance equation is the most common method for prediction of air overpressure impacts. Given the variability in blast orientation and atmospheric conditions, modelling and prediction of air overpressure impacts is more difficult than ground vibration.

In relation to surface blasting activities, measured data has been to establish the following equation for the prediction of peak air overpressure levels:

$$dBL = 166 - 24\log\left(\frac{R}{\sqrt[3]{Q}}\right)$$

Where *dBL* *Peak overpressure in dB(Linear);*

R *distance between source and point of measurement in metres;*

Q *effective charge weight per delay in kg.*

With respect to the underground blasting activities, impacts relating to air overpressure are only anticipated in the initial stages of the decline development close to the portal. Monitoring data measured both in the near and far field from development blasting close to the portal has been used to establish an attenuation equation which has the following form:

$$dBL = 165 - 19.9\log(R)$$

Where *dBL* *Peak overpressure in dB(Linear);*

R *distance between source and point of measurement in metres;*

The above attenuation equation is based on “favourable” blasting conditions with tight controls over practices.

Once the underground operation is established and blasting is occurring well down in the working, air overpressure from stope blasting is not expected to be an issue.

4.2.1 Mitigation Measures for Controlling Air Overpressure

The sources of air overpressure include the vibration of the rock mass, the movement of the rock at the bench face and the venting of gases through the collar or free face. Peak levels resulting from venting of gases can be minimised with the implementation of tight controls over blast loading practices. The impact of the vibration of the rock mass or movement of the face will require modifications to the blast design. In order to address this it may include one or more of the following measures:

- Increased confinement through increased burdens and/or stemming;
- Reduction in the surface area of the free face;
- Reduction in blasthole diameter;
- Reduction in charge weights;
- Reduction in the bench height;
- Modifications to initiation sequencing; and.

It should be noted that whilst such modifications will assist in reducing environmental impacts, there may also be a detrimental effect in terms of blast performance and efficiency.

4.3 Flyrock

Blasting practices require some movement of rock to facilitate the excavation process. The extent of movement is dependent on the scale and type of operation. For example, blasting activities within large coal mines are designed to cast the blasted material much greater distances than practices in a small scale quarrying operation.

Recommended blast clearance distances based on a standard bench blast have been detailed in the Hillside Project 'Drill and Blast Management Plan' developed by Mining Plus. In order to maintain the 426m blast clearance zone from the final open pit rim, implementation of modified blasting practices will be required in areas near the edges of the open pit. Modifications to blasting practices include changes to blast design parameters (hole diameters, stemming lengths etc.) and management of the loading methods.

Where blast clearance zones encroach on neighbouring rural paddocks outside the mine lease, timely notification of blasting activities should be supplied. This should include a clear plan indicating the blast location, proposed time and extent of blast clearance area. Consistency in the firing times where possible can also minimise inconvenience and disruption.

4.3.1 Mitigation Measures for Controlling Flyrock

The extent of rock displacement can be managed with the implementation of tight controls over blasting practices. The occurrence of flyrock is likely to be generated from either the vertical face(s) or the collar (or top) of the blast. This highlights the importance strict controls of blast loading practices including:

- Adequate confinement of explosives with respect to both stemming heights and front row burdens are to be maintained at all times;
- Use of buffered blasting (where rock is blasted into previously shot material);
- Free faces should be checked to ensure there are no areas which are underburdened. This can include the use of 3D survey of free faces and front row holes;
- Accurate loading of charge weights ensuring holes are not overloaded;
- Monitoring the rise of the explosive column in the blasthole during the loading process with explosive product to be removed from overloaded holes prior to adding stemming material;
- Appropriate stemming material and control over loading;
- Manual Quality Control measuring and recording hole depths, explosive weight, explosive column and stemming height;
- Review of video following each blast to assess the extent of rock movement.

The processes which control air overpressure levels and flyrock are the same and therefore, the restrictions imposed to blasting activities based on regulatory

compliance requirements should in turn act as a safety control, restricting the extent of rock displacement.

5. MODELLED BLASTING IMPACTS

The modelling of blasting impacts including ground vibration and air overpressure have been based on the attenuation equations detailed in Sections 4.1 and 4.2, respectively. Maximum charge weights have been determined from the proposed designs for each of the blasting methods in both open cut and underground scenarios.

Illustrated in *Figure 3 – Hillside Project – Extent of Vibration Impacts from Open Pit Blasting* is the extent of vibration levels from the open pit blasting. This is based on blasting at the extremities of the pit and is considered the "worst case" scenario. Predicted vibration levels are not anticipated to exceed 3 millimetres per second at the closest sensitive receptor to the southwest. This would only relate to blasting in the southern part of the pit, with vibration levels likely to drop significantly when blasting in the northern region. Similarly with respect to air overpressure, the contours illustrated in *Figure 4 - Hillside Project – Extent of Overpressure Impacts from Open Pit Blasting* indicate air overpressure levels would also be compliant.

Figure 5 - Hillside Project – Extent of Vibration Impacts from Underground Blasting details the extent of ground vibration induced from the underground blasting. The contours are controlled by the longhole stope blasting activities. Once again, peak vibration levels at the closest sensitive receptor are well within compliance levels.

Figure 6 - Hillside Project – Extent of Overpressure Impacts from Underground Blasting details the extent of overpressure levels produced from development blasting. The contours are based on favourable conditions with tight controls on practices. It should be noted that directionality and topographic relief have not been taken into consideration. This should further assist to reduce levels given the orientation of the southern portal and the depth at which it is located in the pit.

6. BLASTING IMPACTS IN PERSPECTIVE

There has been extensive international research into the effects of blast vibration and overpressure on both personal amenity and the potential for structural damage. Similarly, the community, fauna and structures are subject to both vibration and air overpressure resulting from non-blast related sources on a regular basis.

6.1 Sources of Vibration

The limits as recommended in AS2187.2 are based on minimising human discomfort and are well below the levels likely to produce structural damage. It is important to note that the likely vibration limits with which the Hillside Project will need to comply with are amongst the most stringent international compliance requirements. To highlight the conservative nature of these vibration limits, *Figure 7 - Everyday sources of vibration induced in residential dwellings* details a range of common vibration sources around the typical residential household.

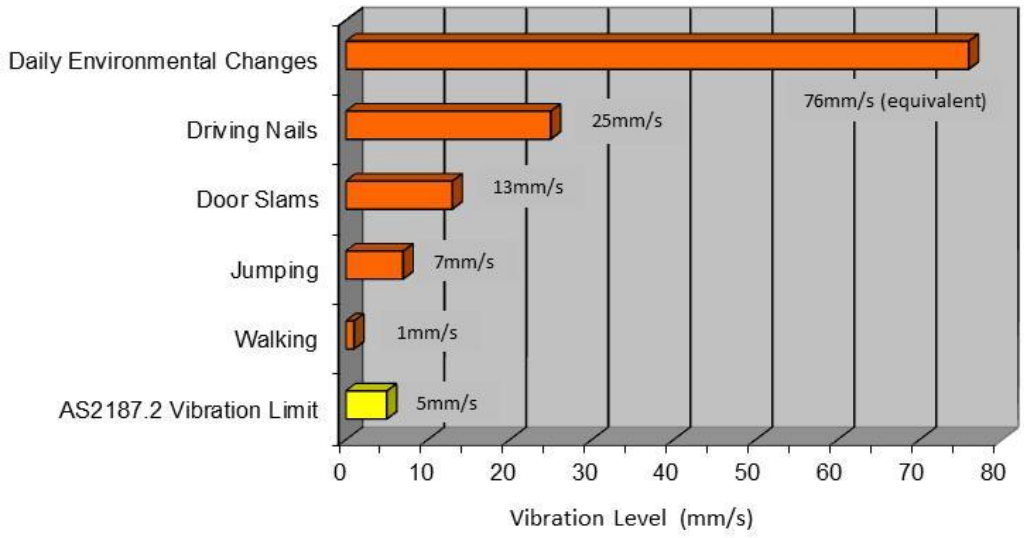


Figure 7: *Everyday sources of vibration induced in residential dwellings*

Activities such as jumping, slamming doors or hammering in a nail can produce vibration levels in excess of 5 mm/s. Similarly, daily temperature fluctuations causing expansion and contraction within residential structures can produce strains equivalent to vibration levels which are 15 times the Australian Standard guidelines.

6.2 Sources of Air Overpressure

Air overpressure is simply the pressure difference, relative to "normal" or "ambient" in air pressure. This means that it is not limited to blasting but is influenced by anything that causes fluctuations in pressure which can include:

- Wind;
- Lightning;
- Trucks;
- Trains;
- Fireworks.

In order to demonstrate the influence of environmental factors on overpressure levels, Saros undertook a study over a 1 month period by correlating wind speed measurements with peak overpressure levels recorded at an adjacent location. Over the 1 month monitoring duration, in excess of 370,000 overpressure measurements were obtained as illustrated in *Figure 8 - Wind speed vs overpressure measurements over a 1 month period*. More than 4,500 (>1%) non-blast related events exceeding the 115dBL level, with a maximum level in excess of 135dBL.

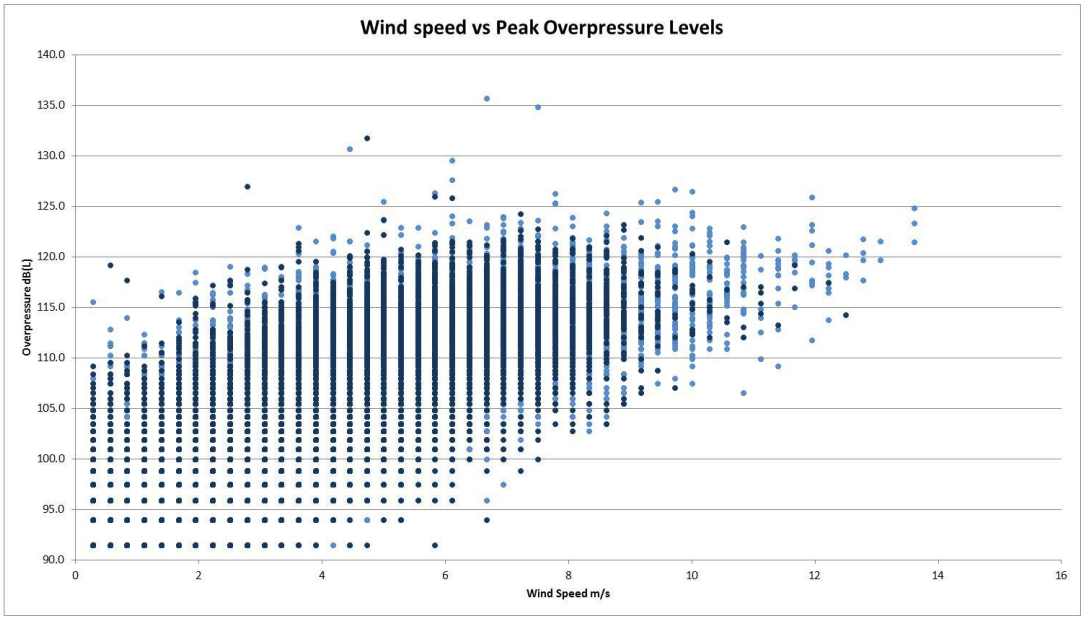


Figure 8: *Wind speed vs overpressure measurements over a 1 month period*

Like ground vibration, overpressure decays rapidly with distance from the blast area, however this decay depends greatly on the weather conditions at the time of blasting. As with audible noise, wind tends to concentrate overpressure meaning the downwind receivers will experience higher levels than receivers at the same distance up wind. Overpressure travels through the air at a slower speed than ground vibration travels through the ground and will therefore arrive at a location sometime after the ground vibration (approximately 3 seconds for every kilometre from the source). Overpressure interacts with structures as it passes and may cause rattling of windows, doors etc. The level of overpressure required to cause damage to building has been well researched and extremely high levels are require to cause minor damage (i.e. broken windows >150dBL).

6.3 Effects on Wildlife and Marine Fauna

Less information is available on the direct impacts of short term transient vibration and overpressure levels on animals. Currently no prescriptive limits apply in Australia. There are numerous mining and extractive industry sites which are located immediately adjacent to rural properties and native habitats. In our experience the vibration and air overpressure limits prescribed and the magnitude of levels predicted from the Hillside Project blasting activities will not adversely affect animals and livestock. This includes investigations of blasting impacts from an open pit mine in central NSW which is situated immediately adjacent to a large wetlands lake. Compliance limits imposed on the critical breeding areas of the lake are in line with the AS2187.2 guidelines. There has been no noticeable disturbance to waterbird activity during blasting.

Similarly, with respect to marine life, the majority of investigations focus on underwater noise and vibration induced from high energy sources within the water course (ie ocean seismic surveys, underwater blasting and piling for construction, wind farms etc). Work conducted by Wright and Hopky[2] (1998) developed guidelines

[2] Wright D.G & Hopky G.E 1998 – Canadian Technical Report of Fisheries and Aquatic Sciences 2107, Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters

for the use of explosive in or adjacent to fish habitats. The guidelines which have been adopted by the Canadian Department of Fisheries and Oceans are designed to conserve and protect fish, marine mammals and their habitats. The guidelines detail standoff distances for varying substrate type (ie rock, saturated/unsaturated soils etc). Assuming a rock substrate (worst case scenario), the recommended set back distances from the fish habitat based on the proposed blasting practices would be 93 metres. Blasting on the eastern side of the pit should not encroach any closer than 600 metres from the coastline. In addition, the sand interface between the substrate and water contact should further impede the vibration transmission into the water.

7. MONITORING PROGRAM

It is important that a comprehensive blast monitoring program be established to assess compliance and provide a platform for the ongoing management and improvement of blasting practices. It is recommended the monitoring program includes the following:

- Measurement of ground vibration and air overpressure levels;
- Video record of the blast for surface blasting;
- Blast design and loading details;
- Blast location; and
- Geological and ground conditions.

With respect to ground vibration and air overpressure effects, it is recommended the compliance monitoring program should include a minimum of two locations, and where possible adjacent to the closest sensitive receptors. Monitors should be configured to record waveforms events and/or continuous peak levels to allow for the verification of results and determine the influence of extraneous factors including localised activity and environmental factors. In the case where a registered complaint is received, monitoring should be conducted at the complaint location for a sufficient period of time to check compliance.

It is also recommended video records be captured for the open pit blasting activities. This should be analysed as part of the post blast analysis and is a useful tool when assessing rock movement and air overpressure controls.

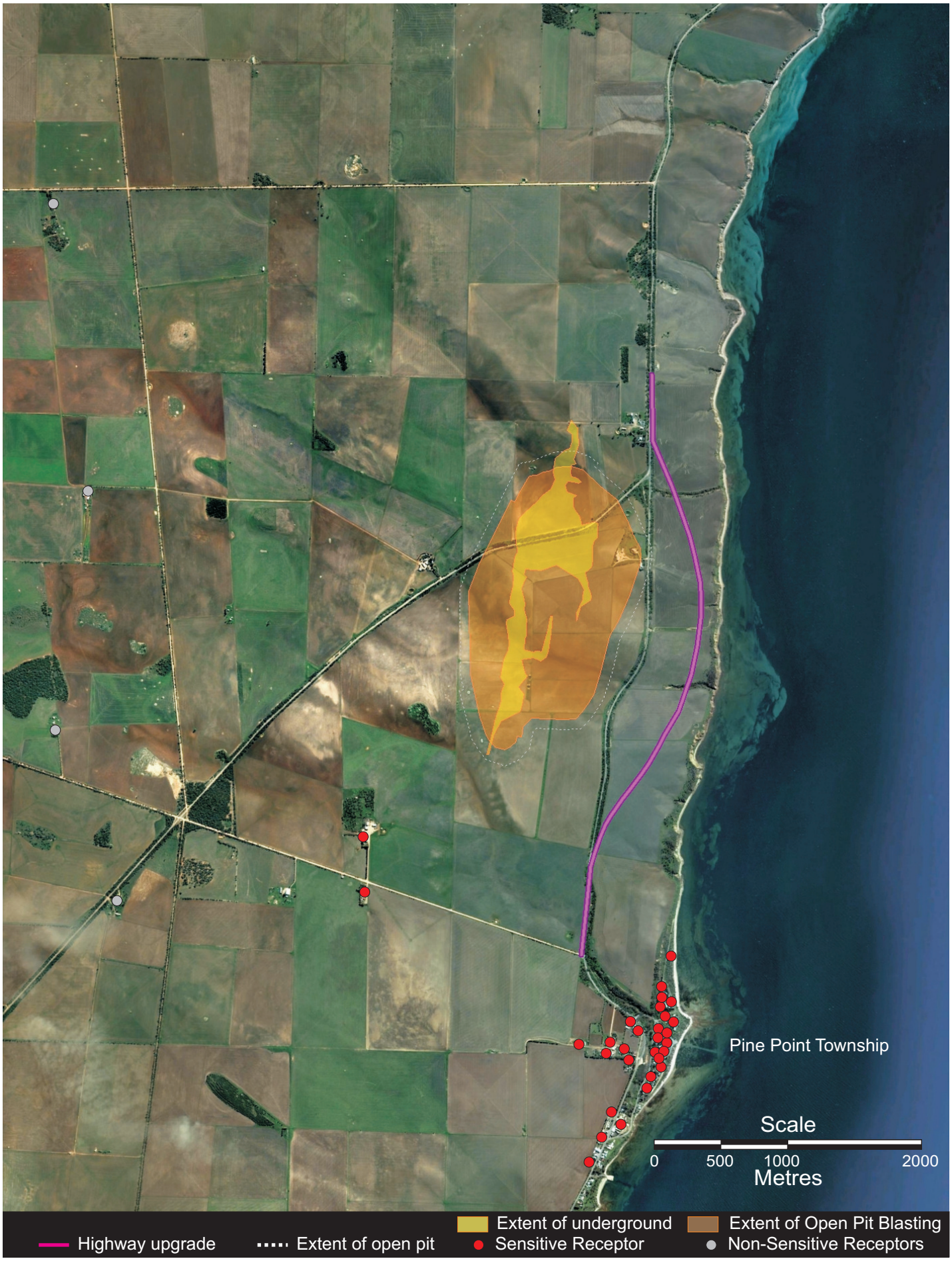
All relevant blast design and monitoring information should be maintained in a consistent format and within a database that is easily accessible to all personnel responsible for the design and loading of blasting practices, both surface and underground.

8. CONCLUSIONS

The blasting impact assessment has been undertaken for both surface and underground blasting activities proposed for the Hillside Project. Analysis and modelling of vibration and air overpressure impacts has been based on site data and experience from similar type operations. The key findings from the investigation are as follows:

- Whilst it is anticipated that blasting will not be required in the initial phase of the open pit until a depth of around 80 metres from the surface, this will depend on the rock strength and variable geology within the pit;
- Modelling of the ground vibration impacts indicate the proposed open pit blast design (10 metre benches with 229mm diameter blastholes) can be utilised throughout the pit whilst maintaining compliance with 5mm/s limit;
- Modelling of the air overpressure impacts indicate the proposed open pit blast design (10 metre benches with 229mm diameter blastholes) can be utilised throughout the pit whilst maintaining compliance with 115dBL limit;
- Modelling of the longhole stope blasting can be utilised throughout the underground workings whilst maintaining compliance with the 5mm/s ground vibration limit;
- The implementation of modified blasting design and charging practices will be required in some areas at the extremities of the pit due to ensure safe stand-off distance. Any modifications to design or loading should be conducted in accordance with the Drill and Blast Management Plan;
- Recommendation for consistent blast firing times where possible and timely notification to neighbouring sensitive receptors that may be directly affected by the blasting activities (i.e. impacted by blast clearance zone);
- Even when blasting is at full production, exposure to blasting impacts will equate to a few seconds each day; and
- Regulatory compliance limits are based on human comfort levels rather than damage thresholds, and therefore, compliance with the licence conditions will minimise human discomfort and prevent any likelihood of damage to neighbouring structures.

FIGURES 2 - 6



Title: Hillside Project - Open cut and underground operations

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Figure: 2

Date Prepared: 25th February, 2013

Ref No: REX01 - Hillside Project.cdr

Title: Hillside Project - Extent of Vibration Impacts from Open Pit Blasting

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Figure: 3

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Ref No: REX01 - Open pit - vibration contours.cdr

Title: Hillside Project - Extent of Overpressure Impacts from Open Pit Blasting

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Figure: 4

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Ref No: REX01 - Open pit - Overpressure contours.cdr

Title: Hillside Project - Extent of Vibration Impacts from Underground Blasting

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Figure: 5

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Ref No: REX01 - underground - Vibration contours.cdr

Title: Hillside Project - Extent of Overpressure Impacts from Underground Blasting

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Rex Minerals
11 March 2013
Document No. 60279729-A13C02RP

Hillside Mine

Mobile Plant Headlight Line of Sight Assessment

Hillside Mine

Mobile Plant Headlight Line of Sight Assessment

Prepared for

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11 March 2013

60279729

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Quality Information

Document Hillside Mine

Ref 60279729

Date 11 March 2013

Prepared by Adam Cook

Reviewed by Darren Jurevicius

Revision History

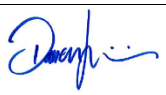
Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	05-Mar-2013	Initial issue	Darren Jurevicius Technical Director - Acoustics	
1	11-Mar-2013	Revised	Darren Jurevicius Technical Director - Acoustics	

Table of Contents

1.0 Introduction

AECOM was engaged by Rex Minerals to provide a mobile plant headlight line of sight analysis as part of the Mining Lease Proposal (MLP) for the proposed Hillside Mine.

Our assessment has determined which of the surrounding receivers to the mine operation have direct line of sight with the haul roads and therefore have the potential to interface with headlights of trucks and vehicles operating on the haul roads.

1.1 Project description

The Hillside Mine site is located approximately 12 km south of Ardrossan, South Australia. The proposed mine is to utilise an open-cut pit, mining iron and copper ores. A processing facility is to be situated on the mine site, with crushing, milling, and concentration capacity. Waste rock dumps are located surrounding the pit and processing facility.

The development also includes a port facility to be located in Ardrossan, adjacent to the existing Arrium and Viterra facilities. The Rex Minerals port facility will house stockpiles of the magnetite and copper concentrates in sheds, which are later transported to bulk-carrier ships docked at the port via conveyer system. We understand that the existing wharf structure will be refitted with an upgraded conveyer and a new ship-loading system.

The processed magnetite and copper concentrates are to be transported to the port facility from the mine site via an underground slurry pipeline.

The location of the mine, port facility and the slurry pipeline are shown in Figure 1.

HAM

Port Vincent Ardrossan Rd (Main Coast Rd)

JAMES WELL

ROGUES POINT

St Vincent Hwy

Yorke Hwy

MULARA

PINE POINT

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N

DATUM GDA 1994, PROJECTION MGA ZONE 53

0 550 1,100 2,200

metres

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LEGEND

Roads - Existing
- Major Highway
- Main Road
- Minor Road
- Track

- Site layout - fixed plant
- Pipeline
- Proposed road re-alignment
- Mine site land tenure
- Port facility land tenure
- Site features

Hillside Mine
Mine and port facility
General arrangement

PROJECT ID:	60279729
CREATED BY:	AC
LAST MODIFIED:	AC 19/02/2013
VERSION:	1

Map
G-1

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2.0 Headlight Line of Sight Assessment

2.1 Methodology

Light spill from moving sources operating on haul roads was assessed using spatial analysis. Tools available in ESRI's ArcGIS suite of software were used to determine if direct line of sight is possible from particular sensitive receivers to any component of the haul roads.

The model has assumed the following conditions for direct line-of-sight to operational vehicle lights:

- The haul roads are approximately 12 metres wide
- The typical height of lights operating on the haul roads are up to 3.5 metres above ground level.
- Where any part of the haul road is visible from ground height up to 3.5 metres above ground level there is the potential for light spill

2.2 Modelling Inputs

The following inputs were used in the modelling of light spill from mobile sources operating on haul roads.

2.2.1 Haul Roads

3D strings representing the centre of the haul roads were adopted from site layouts provided by Rex Minerals. Accordingly, a buffer 6 metres either side of the string was generated to represent the full width of the haul road and their height was set 3.5 metres above ground height.

2.2.2 Light Source

Cat 793D haul trucks have been specified for use on the haul roads. We have assumed from CAT documentation that truck head lights would be located approximately 3.5 metres above ground height. As smaller light utility vehicles may also operate on the haul roads it has been assumed that the light source can be located from ground level up to a height of 3.5 metres above ground level.

2.2.3 Terrain

3D terrain data was provided by Rex Minerals. Terrain data was provided in the form of 1 metre interval contours for the site locality. Where terrain data was required at further distances, 10 metre contours were sourced from AECOM's internal GIS database.

2.2.4 Nearest Sensitive Receivers

Receiver locations were assessed based upon aerial imagery and input from Rex Minerals regarding land tenure. Approximately 40 sensitive receiver locations were identified in proximity to the mine site. Where multiple receptors were located in close proximity, the receiver with worst-case line-of-sight to the haul roads was chosen as representative of receptors in the cluster. This resulted in 12 sensitive receptors for which the line-of-sight analysis was undertaken. The receptors are shown on Figure 2.

Figure 2 Mine site sensitive receptors

2.3 Scenarios Modelled

Models were produced to predict line of sight for three time periods during mine operation, corresponding to Year 1, Year 5 and Year 12 after mine opening. These time periods are anticipated to be representative of the most significant changes to the mine site layout, and therefore the line of sight for the nearest receptors.

2.4 Modelling Assumptions

The following additional assumptions were made during the modelling process:

- Light from the operation of mobile vehicles on any other roads associated with the mine or by vehicles accessing the mine were not considered.
- Only direct line of sight with mobile plant headlights has been considered.
- Only the changes to terrain (i.e. waste rock dump construction) associated with the modelling scenarios outlined in Section 2.3 were considered. Changes to terrain occurring between the modelled scenarios which have the potential to remove line-of-sight barriers have not been considered.

3.0 Headlight Line of Sight Analysis

3.1 Results

Table 1 outlines the results of the operational light spill modelling. Our assessment has found that up to 12 locations have the potential to have direct line of sight of mobile plant headlights.

Table 1 - Modelling Results

Sensitive Receiver	Number of other receivers represented	Haul Road with direct line of sight		
		Scenario 1 – Period 1	Scenario 2 – Period 5	Scenario 3 – Period 12
14 Pine Point Road (R32)	0	• SE WRD • P4 (SW) • P4 (N) • NE WRD (S) • NE WRD (N)	• W WRD (West)	• FW WRD • P4 (S)
13 Pine Point Road (29)	0	• W WRD • SE WRD • P4 (SW) • P4 (N) • NE WRD (S) • NE WRD (N)	• W WRD (West)	• FW WRD
59 Main Street (R40)	11	No haul roads viable	No haul roads viable	No haul roads viable
2 St Vincent Highway (R50)	3	No haul roads viable	• W WRD (West)	• FW WRD
House East of St Vincent Highway on Rogues Point Road (R19)	1	• NE WRD (S) • NE WRD (N)	No haul roads viable	No haul roads viable
Lot 3 James Well Road (R13)	0	• NE WRD (S) • P4 (N)	• W WRD (West)	• FW WRD
Lot 3 Sandilands Road (R27)	1	• W WRD • SE WRD • NE WRD (N)	• W WRD (East)	• FW WRD
Western House Lot 59 Rogues Point Road (R15)	1	No haul roads viable	No haul roads viable	No haul roads viable
Lot 73 James Well Road (R18)	0	• NE WRD (N) • NE WRD (S) • P4 (N)	• W WRD (West) • W WRD (East)	• FW WRD
Lot 6 Yorke Highway (R33)	1	• W WRD • SE WRD • NE WRD (S)	• W WRD (West)	• FW WRD
Lot 74 Sandy Church Road (R22)	1	• NE WRD (N) • NE WRD (S)	No haul roads viable	• FW WRD
House on Reddings Road (R26)	0	• P4 (N) • NE WRD (N) • NE WRD (S)	No haul roads viable	n/a

4.0 Mitigation

Potential mitigation may be required at a few residential cluster locations based on the results outlined in Table 1. Mitigation may be considered for components of the haul road where direct light spill may be experienced based on the direction of travel and dispersion angle of headlights.

Note that this assessment has not considered the reduction in intensity of light with distance and therefore the light impact at locations further from the mine may not be at a level to cause annoyance.

Should the residential locations experience annoyance from mobile plant light spill, the following mitigation measures could be adopted:

- Earth bunds located alongside necessary sections of the haul roads where practical
- Vegetation either located alongside necessary sections of haul roads or at the affected properties
- Shaping rock dumps where practical.

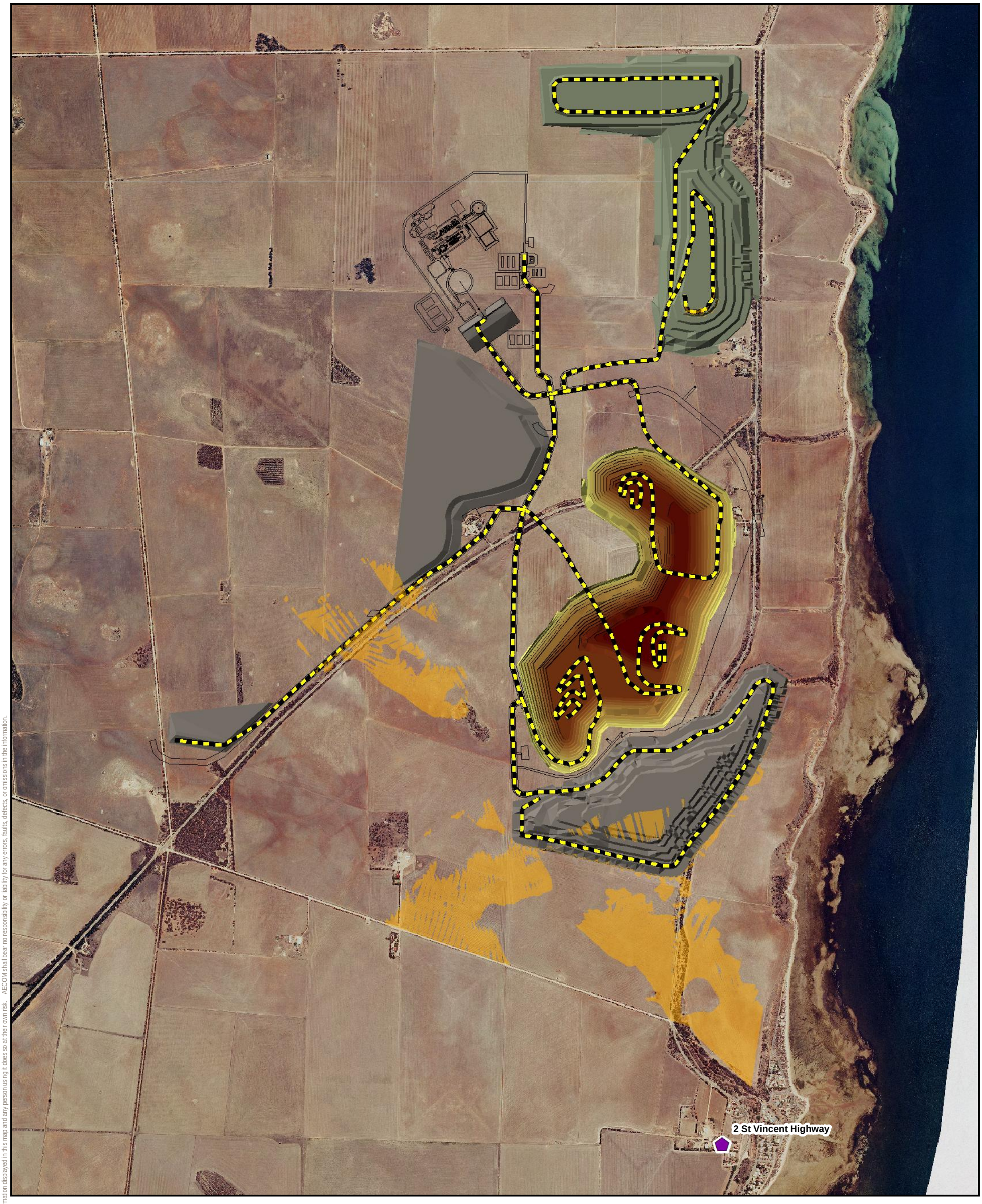
Note that where treatment at a residential property is undertaken, mitigation should be considered for all dwellings within the assessment cluster where practical.

5.0 Conclusion

In summary, it was found that up to 12 sensitive receptor locations have the potential to experience direct line of sight of mobile plant travelling along haul roads. Various mitigation options have been discussed.

Appendix A

Operational Light Spill Maps - Year 1



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Period 1 Haul Roads

2 St Vincent Highway

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

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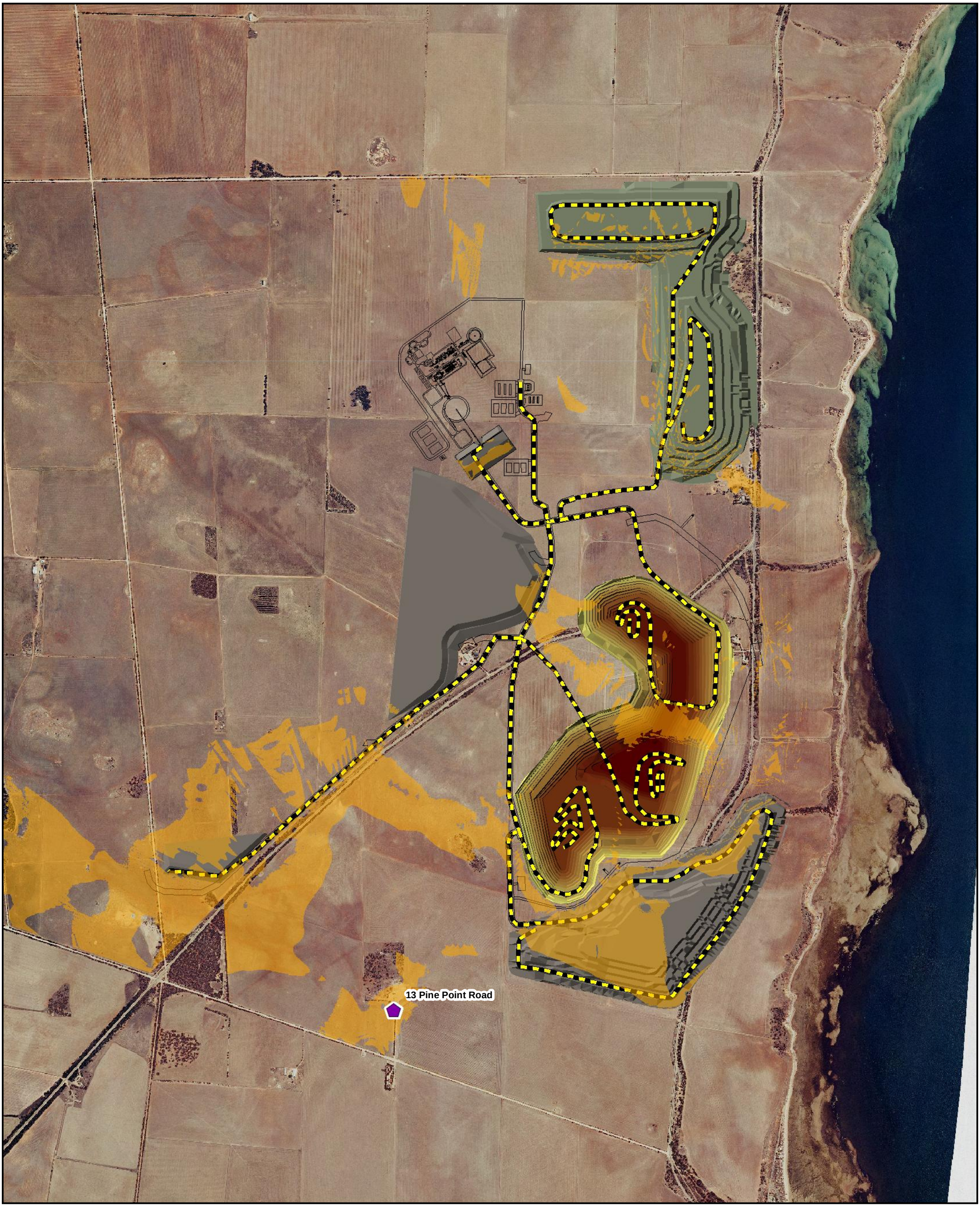

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Period 1 Haul Roads

13 Pine Point Rd

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

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Period 1 Haul Roads

14 Pine Point Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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Period 1 Haul Roads

House East of St Vincent Highway at Rogues Point Rd

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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LEGEND

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- Visable
- Period 1 Haul Roads
- Lot 3 James Well Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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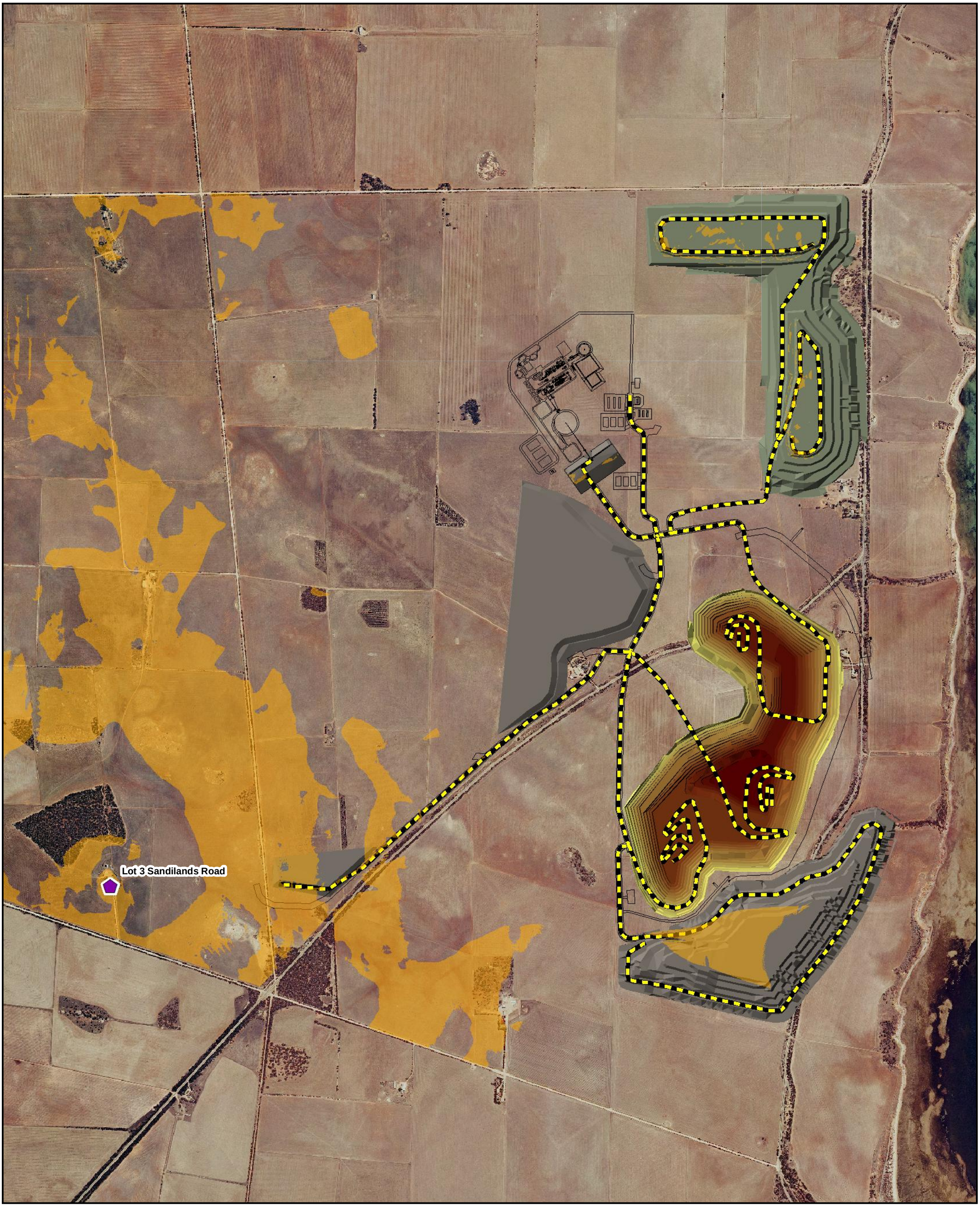

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LEGEND

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- Visable
- Period 1 Haul Roads
- Lot 3 Sandilands Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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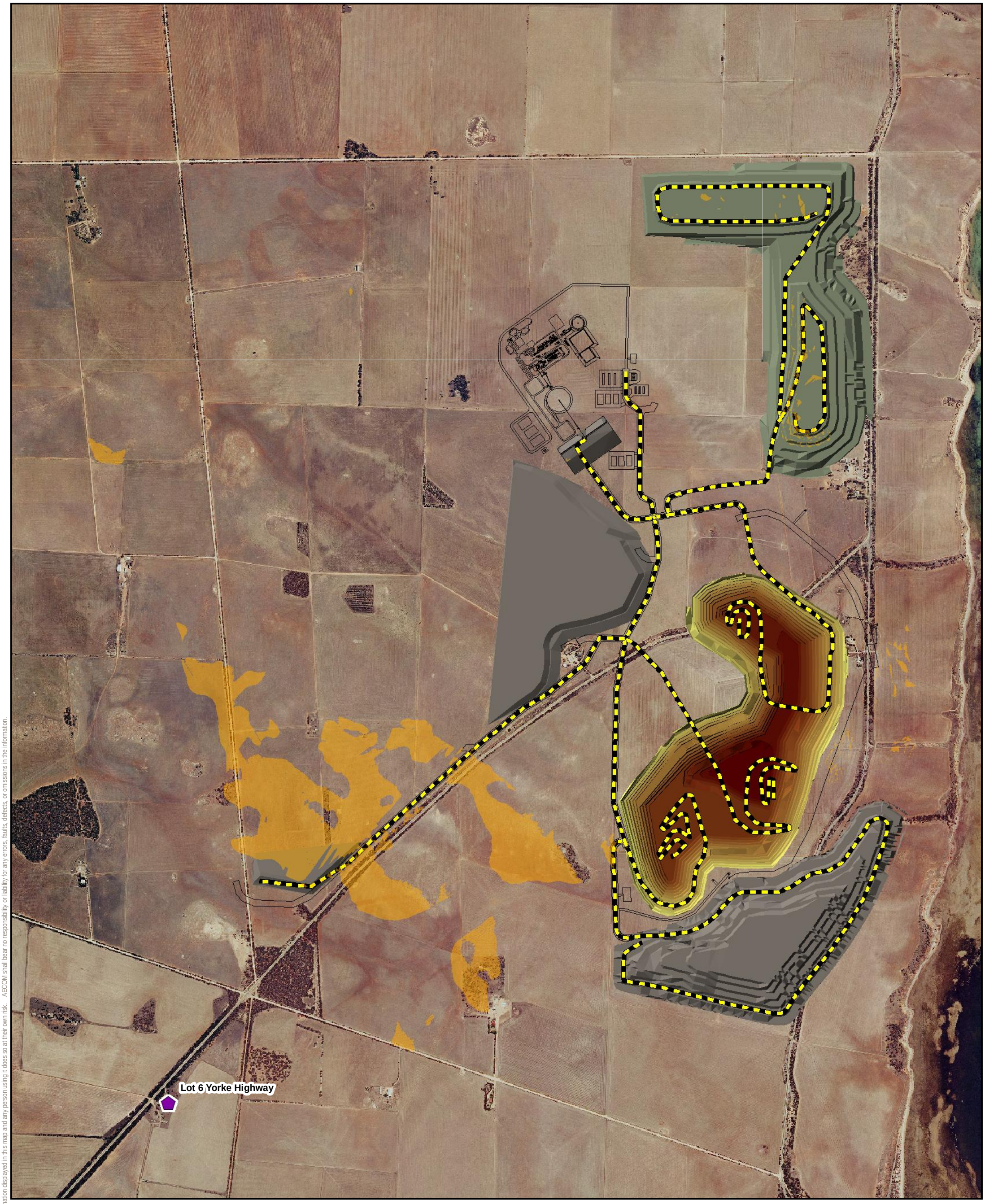

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Period 1 Haul Roads

Lot 6 Yorke Highway

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

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- Not Visable
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- Period 1 Haul Roads
- Lot 73 James Well Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map
1-G

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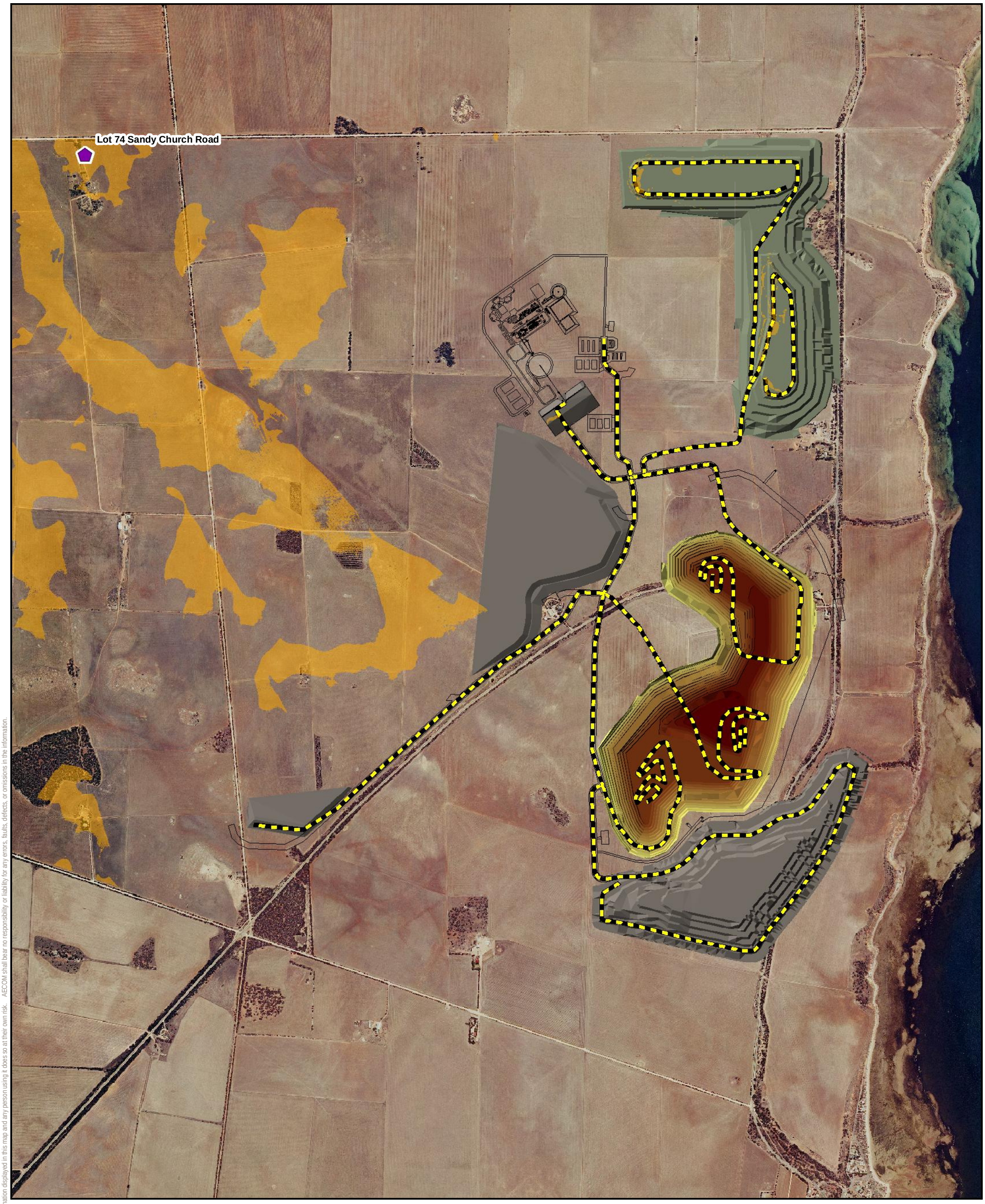

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- Period 1 Haul Roads
- Lot 74 Sandy Church Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 1

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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Appendix B

Operational Light Spill Maps - Year 5

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Period 5 Haul Roads

2 St Vincent Highway

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

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13 Pine Point Road

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Period 5 Haul Roads

13 Pine Point Rd

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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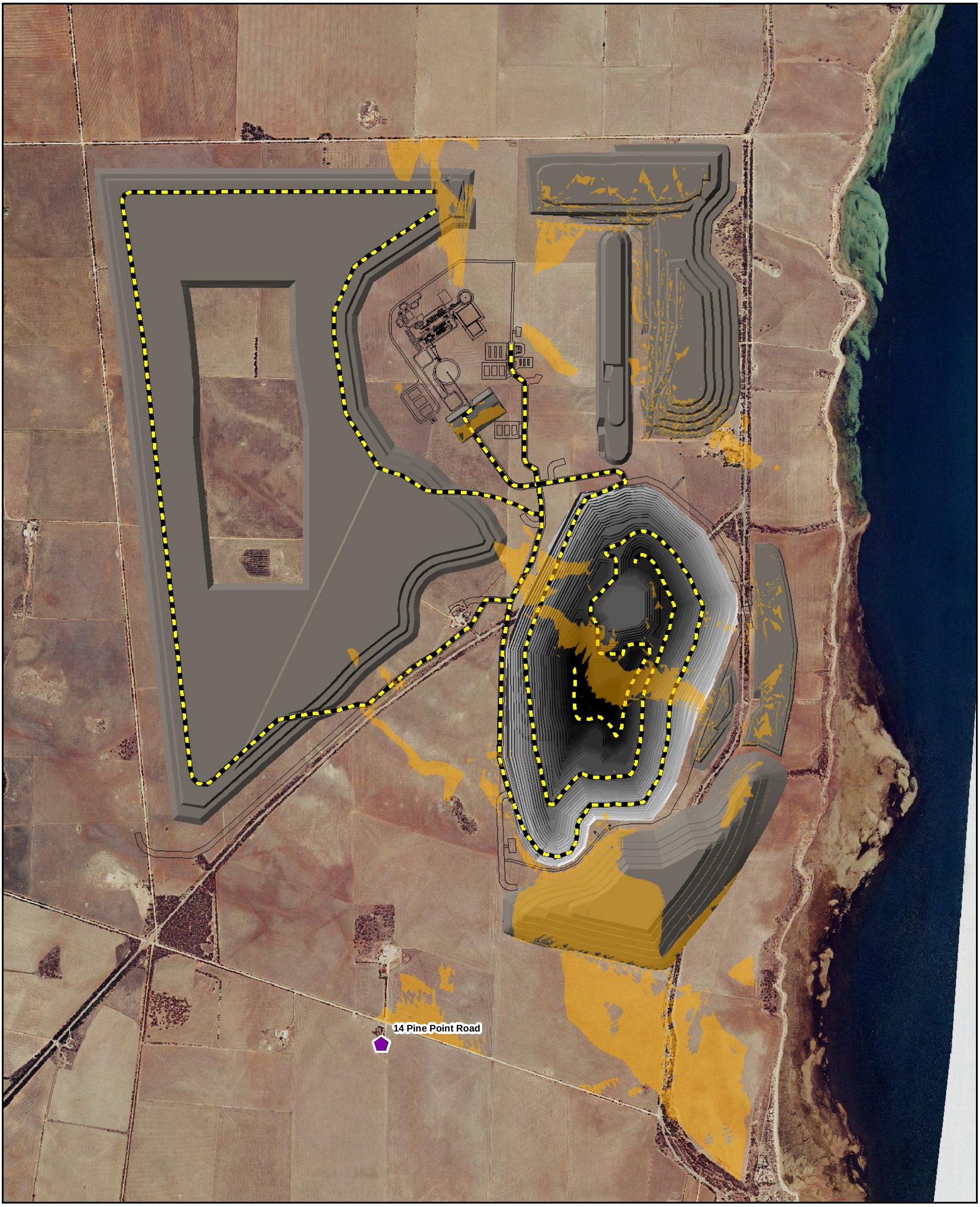

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- Period 5 Haul Roads
- 14 Pine Point Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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Period 5 Haul Roads

House East of St Vincent Highway at Rogues Point Rd

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
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LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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Period 5 Haul Roads

Lot 3 James Well Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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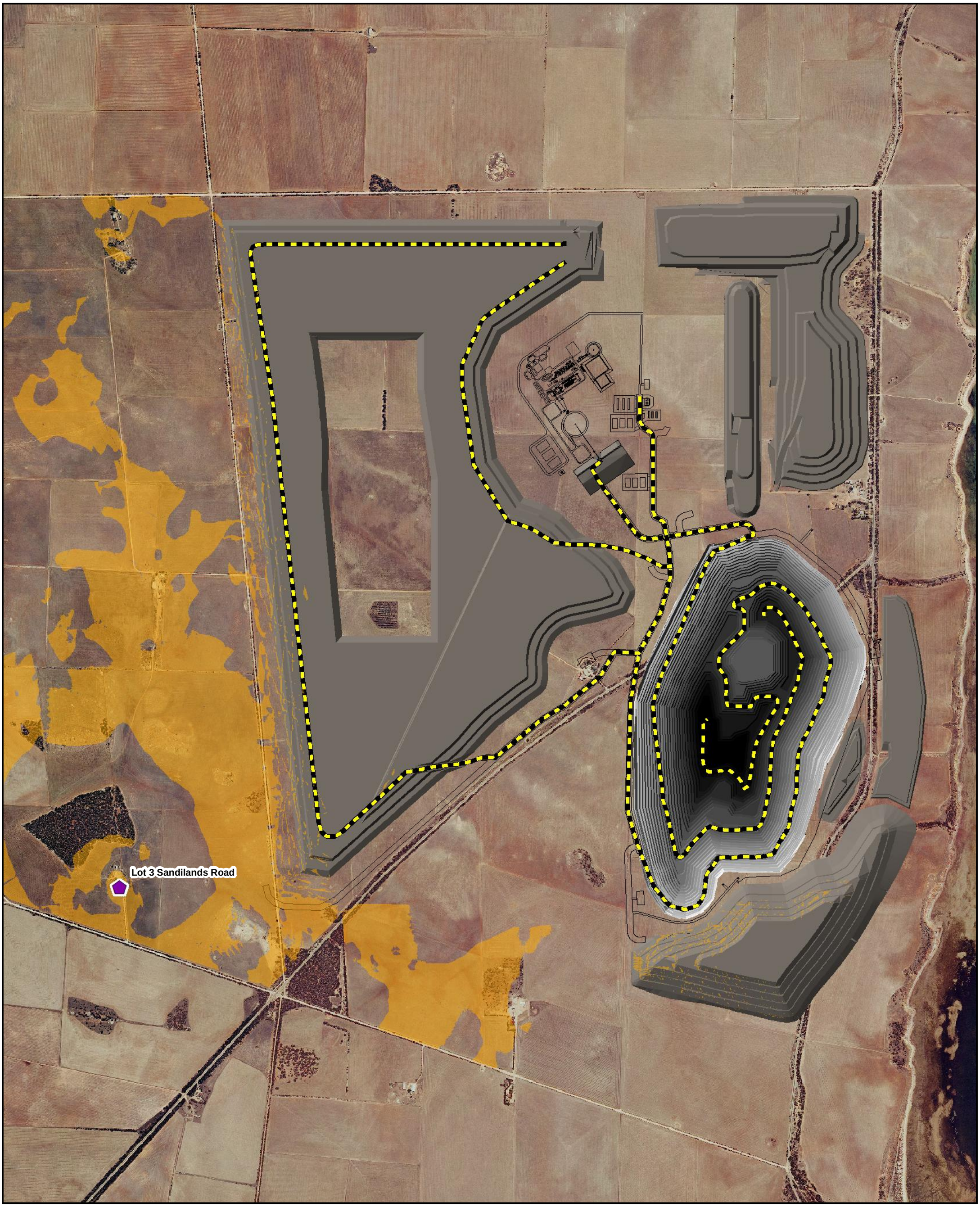

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- Period 5 Haul Roads
- Lot 3 Sandilands Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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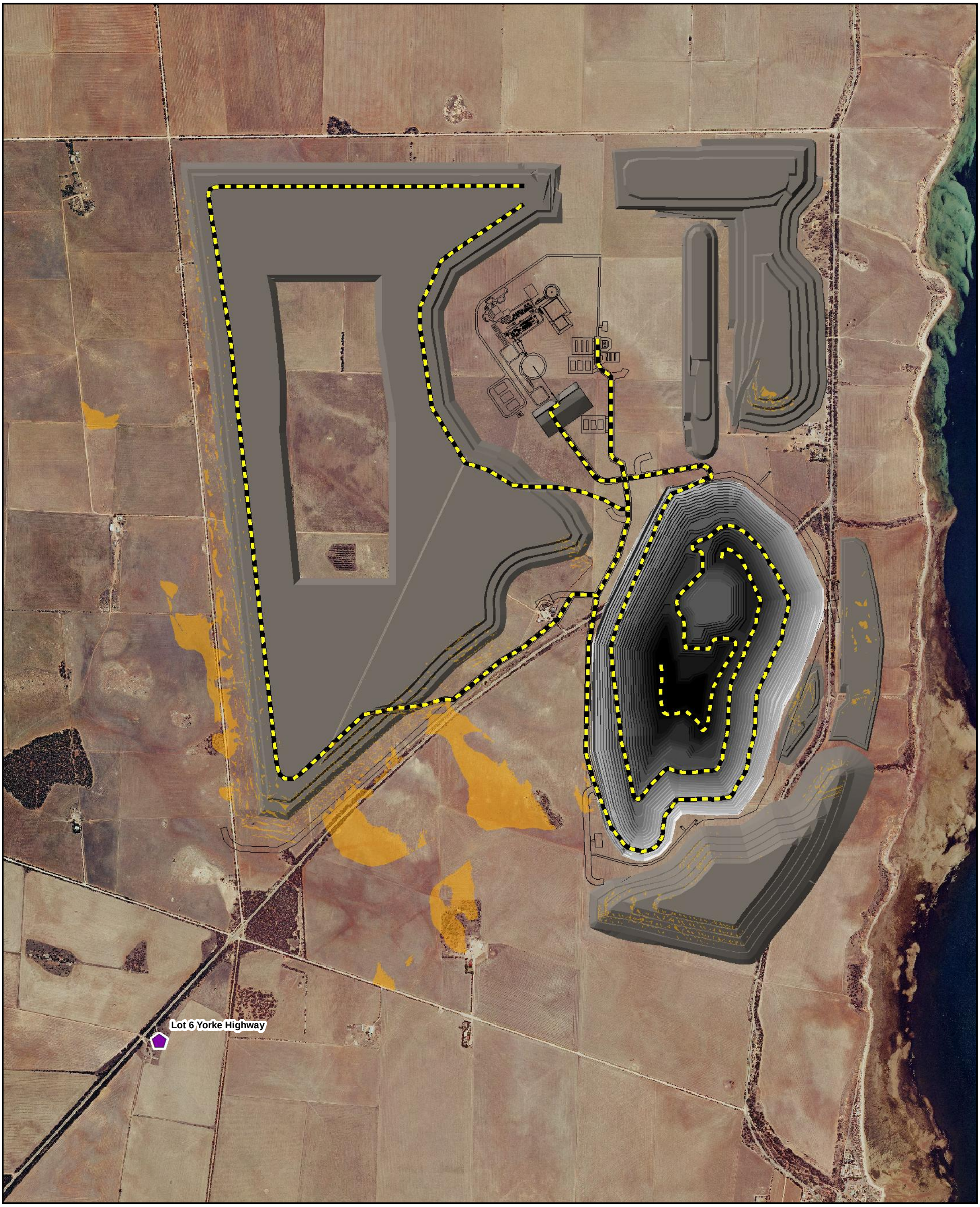

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Period 5 Haul Roads

Lot 6 Yorke Highway

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
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LAST MODIFIED	JS - 08/03/2013
VERSION:	1

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- Period 5 Haul Roads
- Lot 73 James Well Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
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Period 5 Haul Roads

Lot 74 Sandy Church Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 5

PROJECT ID	60279729
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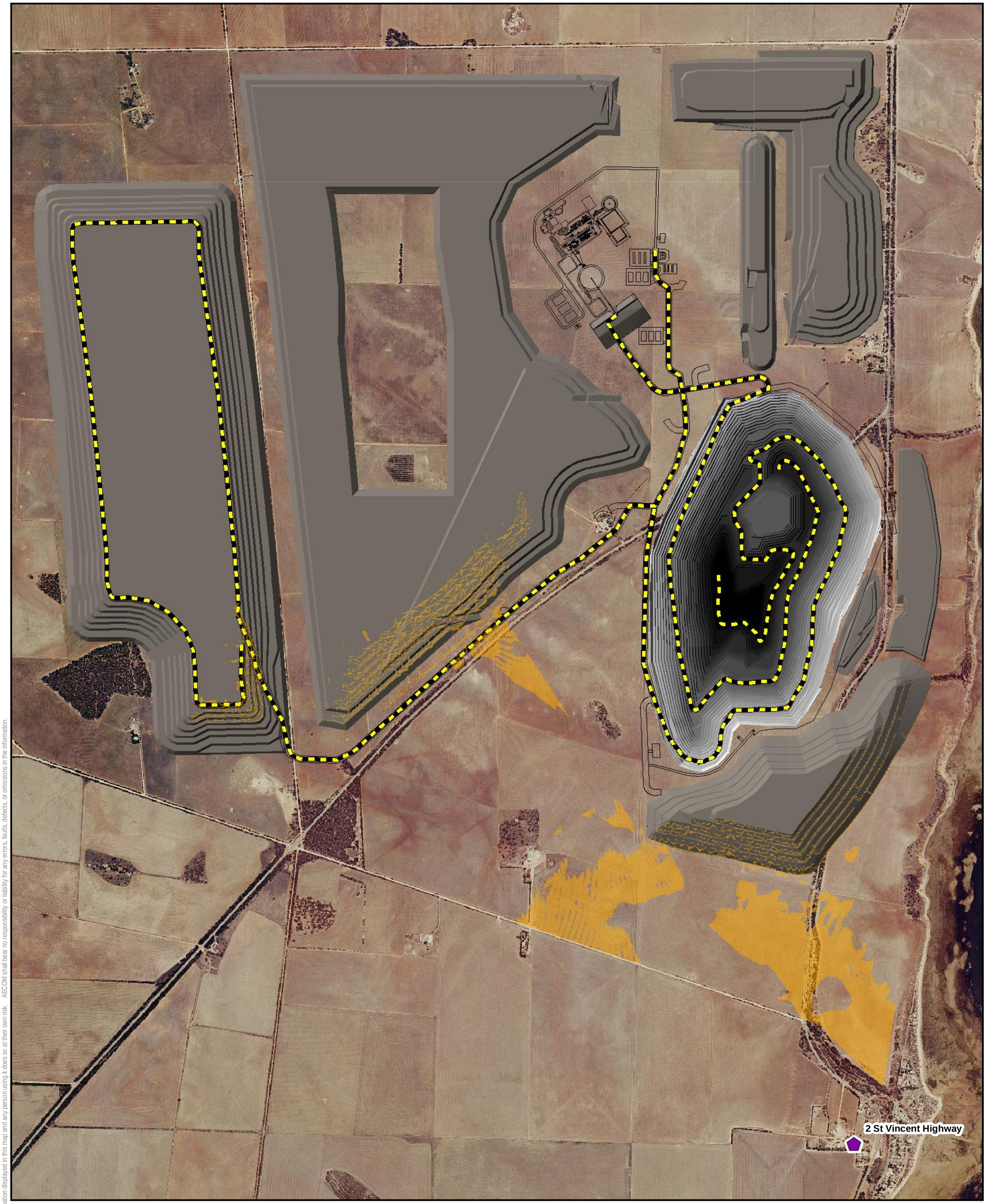
Appendix C

Operational Light Spill Maps - Year 12



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Period 12 Haul Roads

2 St Vincent Highway

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

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- Period 12 Haul Roads
- 13 Pine Point Rd

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

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14 Pine Point Road

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metres

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LEGEND

- Not Visable
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- Period 12 Haul Roads
- 14 Pine Point Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

PROJECT ID	60279729
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DATUM GDA 1994, PROJECTION MGA ZONE 53

0 310 620 1,240

metres

1:25,000 (when printed at A3)

LEGEND

- Not Visable
- Visable
- Period 12 Haul Roads
- House East of St Vincent Highway at Rogues Point Rd

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

12-D

Filename: \\AUBNE1FP004\Modelling\Acoustics_ReferenceData\Temporary Transfer\Hillside\operational - period 2\Hillside Mine period 2.mxd

A3 size

AECOM

www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 53

0 310 620 1,240

metres

1:25,000 (when printed at A3)

LEGEND

- Not Visable
- Visable
- Period 12 Haul Roads
- Lot 3 James Well Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

12-E

A3 size

Filename: \\AUBNE1FP004\Modelling\Acoustics_ReferenceData\Temporary Transfer\Hillside\operational - period 2\Hillside Mine period 2.mxd

AECOM

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DATUM GDA 1994, PROJECTION MGA ZONE 53

0 250 500 1,000

metres

1:20,000 (when printed at A3)

LEGEND

Not Visable

Visable

Period 12 Haul Roads

Lot 3 Sandilands Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

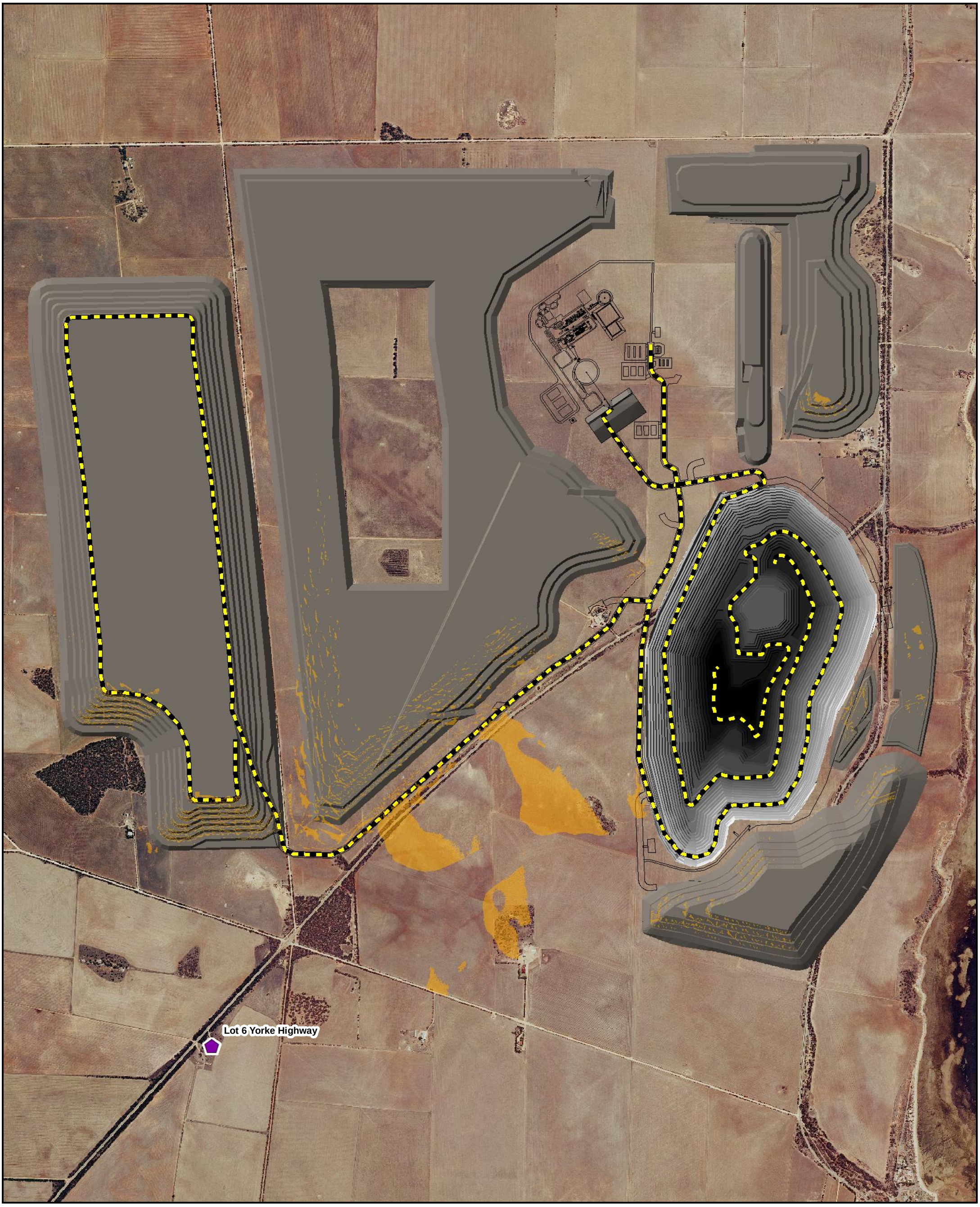
PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

12-F

Filename: \\AUBNE1FP004\Modelling\Acoustics_ReferenceData\Temporary Transfer\Hillside\operational - period 2\Hillside Mine period 2.mxd

A3 size



AECOM

www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 53

0 250 500 1,000

metres

1:20,000 (when printed at A3)

LEGEND

- Not Visable
- Visable
- Period 12 Haul Roads
- Lot 6 Yorke Highway

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

12-H

Filename: \\AUBNE1FP004\Modelling\Acoustics_ReferenceData\Temporary Transfer\Hillside\operational - period 2\Hillside Mine period 2.mxd

A3 size

AECOM

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DATUM GDA 1994, PROJECTION MGA ZONE 53

0 250 500 1,000

metres

1:20,000 (when printed at A3)

LEGEND

Not Visable

Visable

Period 12 Haul Roads

Lot 73 James Well Road

HILLSIDE MINE

Operational Light Spill Assessment

Mine facility - Period 12

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map

12-G

A3 size

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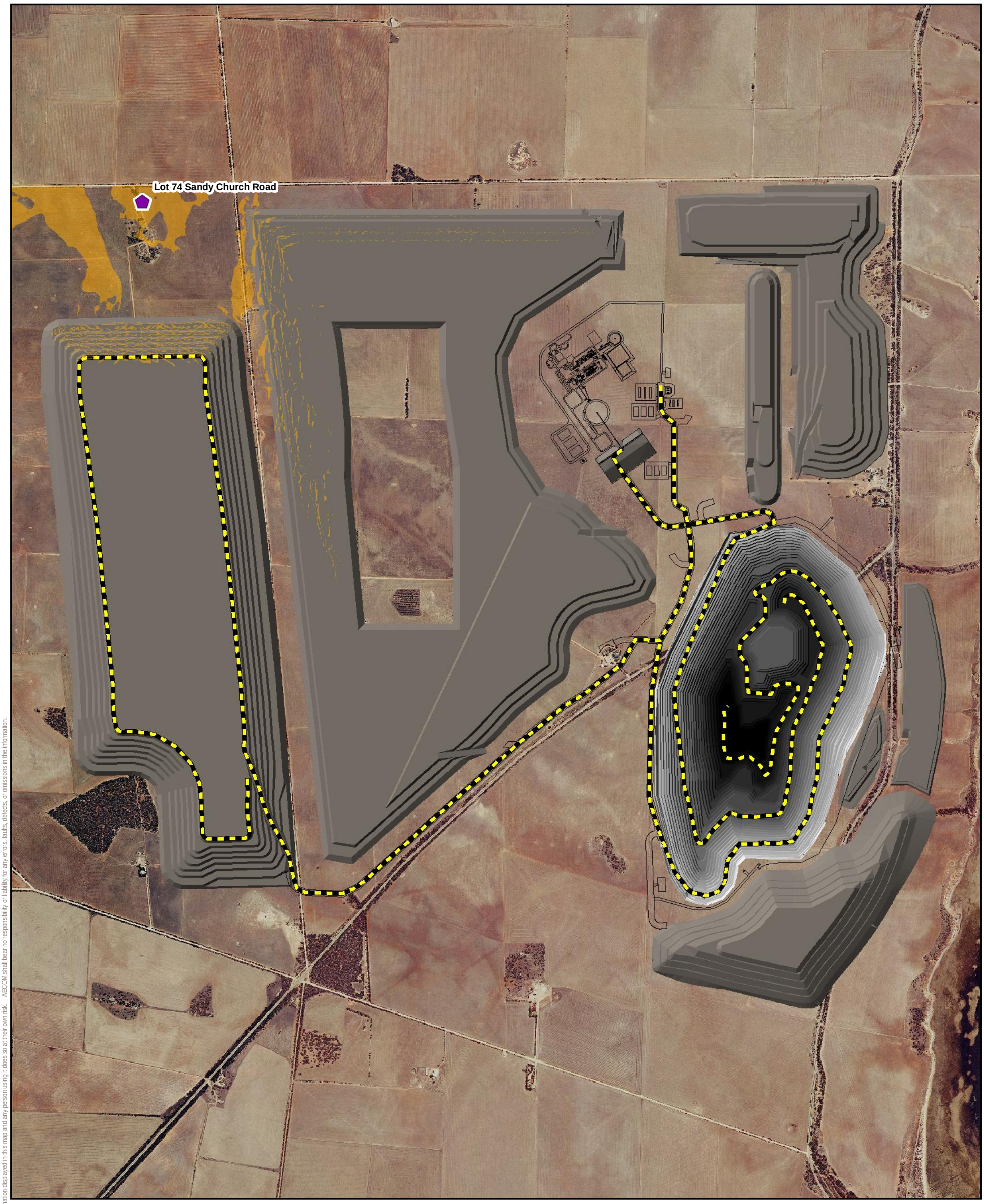

AECOM
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DATUM GDA 1994, PROJECTION MGA ZONE 53

0 250 500 1,000
metres

1:20,000 (when printed at A3)

LEGEND

- Not Visable
- Visable
- Period 12 Haul Roads
- Lot 74 Sandy Church Road

HILLSIDE MINE
Operational Light Spill Assessment
Mine facility - Period 12

PROJECT ID	60279729
CREATED BY	JS
LAST MODIFIED	JS - 08/03/2013
VERSION:	1

Map
12-I
A3 size

Filename: \\AUBNE1FP004\Modelling\Acoustics_ReferenceData\Temporary Transfer\Hillside\operational - period 2\Hillside Mine period 2.mxd