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Introduction
Stawell Gold Mines Pty Ltd (SGM), a wholly owned subsidiary of Crocodile Gold Corporation (CGC), proposes to undertake open cut gold mining adjacent to the Stawell township in western Victoria, within the existing SGM mining license MIN 5260.

The key elements of the Project are:

- open cut mining of two pits (North Pit and South Pit) located in and around Big Hill adjacent to the Stawell township
- transportation of ore via an internal haul road to the existing licenced SGM processing facility
- storage of waste rock generated from the Project at a temporary waste rock stockpile (TWRS) on adjacent previously disturbed land and pasture land.
- full reinstatement of Big Hill to its approximate original topography.

It is expected that the Project will involve approximately four years of mining and a further one year of backfilling. Waste rock from the TWRS and from Mt Micke (a previously mined area within the SGM license area) or a suitable alternative will be used to progressively backfill and re-establish the Big Hill landform within approximately five years from commencement of the Project. Tailings from ore processing will be disposed of at the existing SGM tailings storage facility (TSF) which has the capacity to receive all tailings from the Project. The existing processing plant, TSF and underground operations are not the subject of this EES, which have all required approvals for continued operations.

Project Purpose
The primary rationale for the Project is to fully utilise the last known commercially viable gold resource within the SGM mining licence area. The Project will prolong the mine life enabling continued gold production as SGM works towards the planned closure of underground mining operations. In the event that the Project does not proceed, it is envisaged that all mining and processing activity will cease during 2014-15.

Leading Practice Management
Due to the proximity of the Project to residential areas, SGM has developed a mining operations plan which goes above and beyond standard industry practice. The mining operation will use a significantly different benching and bunding configurations to a ‘normal’ open pit mine to mitigate impacts and proposes a range of management and operating measures which have been benchmarked as leading practice.

Table ES 1 summarises the leading operational and management practices adopted by SGM to mitigate any unacceptable potential impacts that may otherwise be experienced by nearby residents.
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Table ES 1  Leading practice management and mitigation measures

<table>
<thead>
<tr>
<th>Practice</th>
<th>SGM Modified Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational hours</td>
<td>62% reduction in working hours from current SGM operations to day time, week day only.</td>
</tr>
<tr>
<td>Pit slope design</td>
<td>Pit wall angles will be conservative to ensure no potential infrastructure issues. Inter-ramp slope angles will also be conservative to further reduce or eliminate risk of small scale failures.</td>
</tr>
<tr>
<td>Bench design</td>
<td>To ensure that optimum shielding of activities and maximum dust and noise containment is achieved, the pit floor is to be pushed as deep as possible with multiple benches in operation.</td>
</tr>
<tr>
<td>Ramp width</td>
<td>Project to use single lane with passing bays to accommodate other mine design elements required to achieve regulatory compliance in relation to noise and dust and to reduce overall pit footprint.</td>
</tr>
<tr>
<td>Truck selection</td>
<td>The Project has opted for larger trucks resulting in decreased vehicle movements at equivalent or lower noise emissions of smaller vehicles. Late model new or low hour trucks specified for Project, due to quieter running conditions of later generation engine and drive train systems.</td>
</tr>
<tr>
<td>Excavator selection</td>
<td>Two excavators will be used from Year 2 and the South Pit is commenced. One of the excavators will be larger than normally used for this type of mining (190 – 200 tonne range) to ensure that sufficient force can be applied to the material for free dig as part of the commitment to reduce blasting requirements for amenity reasons.</td>
</tr>
<tr>
<td>Excavation controls</td>
<td>GPS guidance will be used on all primary excavation equipment (excavators and bulldozers) to ensure that planned mining dimensions are strictly adhered to and to ensure that waste rock generation is minimised.</td>
</tr>
<tr>
<td>Staged mining (South Pit)</td>
<td>In order to reduce the time that the full South Pit area is in operation and reduce the noise and dust generation to residents along Fisher St, the South Pit will be mined as a two stage cut back approach. This will result in greater noise and dust containment.</td>
</tr>
<tr>
<td>Excavation method</td>
<td>Blasting only where necessary and generally deeper in the pits, otherwise maximise rip and dig to minimise amenity concerns over blasting even though compliance with blasting regulations is achievable.</td>
</tr>
<tr>
<td>Blasting</td>
<td>Blast management plan based on actual onsite monitoring and modelling of blasting to design a reduced blast mass to achieve compliance when blasting is at closest point to houses or commercial properties.</td>
</tr>
<tr>
<td>Work areas</td>
<td>Mining with staged cutbacks to reduce operational footprint and the overall impact for residents closest to the western boundary of the North and South Pits.</td>
</tr>
<tr>
<td>Haul road construction</td>
<td>Sealing haul roads to reduce dust generation through the application of sealing agents and use of low silt content material specification on unsealed haul roads.</td>
</tr>
<tr>
<td>Waste rock stockpile design</td>
<td>In order to minimise noise and dust to the maximum extent possible, the approach to the construction of the TWRS facility will be to start at the outer edge and work inwards and back toward the pit operations. A five meter noise and dust bund will also be constructed around the outer perimeter to the TWRS. Dust generation will also be minimised by reducing the drop height of material being tipped from the equipment.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Practice</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Backfilling methodology</td>
<td>Tip heights during backfilling will also be reduced to minimise dust generation. It is expected that two fill placement horizons will be used below the lower pit crest in both pits. The tip faces are to advance from opposite directions of the pit for each lift to ensure that similar compaction and settlement is applied across the entire area. Once the filling horizons are approaching the height of the lowest pit crest and shielding of placement activities is reduced, the filling methodology is to change to the same as that at the TWRS. The equipment traversing the fill area for paddock dumping will apply compaction to the placed fill. Any settlement that occurs during filling will be remedied immediately.</td>
</tr>
<tr>
<td>Staged clearing</td>
<td>The clearing and grubbing of the pit operational area is to occur in four stages, to minimise the land disturbance at any one time, reduce potential for dust generation and allow for reduced visual impact.</td>
</tr>
<tr>
<td>Noise attenuation equipment</td>
<td>Modification of mobile plant with best available noise attenuation/suppression equipment. Acoustic enclosures around the rock breaker. Use of ‘smart alarms’ rather than traditional reversing alarms.</td>
</tr>
<tr>
<td>Dust Suppression</td>
<td>Multiple water carts and full-time grader on site, with use of chemical dust suppressants to ensure dust management requirements are met. The use of fixed water sprays for some haul roads and waste rock stockpiles.</td>
</tr>
<tr>
<td>Management of waste rock moisture content</td>
<td>Regular monitoring of stockpile moisture content to ensure optimal levels are maintained. The aim is to reduce dust generation and over application of water.</td>
</tr>
<tr>
<td>Monitoring and forecasting</td>
<td>Real-time monitoring and predictive forecasting tools to allow proactive environmental management before the on-set of potential impacts. Ultimate cessation of mining in extreme conditions.</td>
</tr>
</tbody>
</table>

The leading practice measures adopted by SGM have added considerable cost to the Project and represent SGM’s commitment to minimising potential impacts on the community. However, adoption of these measures results in a Project which is highly compliant with regulations and achieves amenity outcomes not achievable using normal mining practices.

Previous Big Hill Development Project EES

SGM proposed a development to mine the same gold resource during the late 1990s. The proposal was the subject of an EES and was ultimately not supported by Government at that time because it ‘did not provide an acceptable balance of economic, social and environmental outcomes’. The independent Panel assessing the proposal identified a range of issues which informed the Government decision, the main ones can be summarised as:

- the proximity of the proposed open cut mine to the Stawell township meant the proposed 8-10 year mine life had the potential to create social impacts over a long period of time.
- the proposal to leave the southern mining pit as unfilled void space would create unacceptable safety and visual amenity concerns.
- the difficulty in reinstating the ‘icon’ values of Big Hill particularly with the southern pit remaining as a void.
- loss of nine hectares of high quality box ironbark forest.
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The Project which is the subject of this EES has addressed the previous issues of concern, most notably committing to a shorter mining life of around 5 years, fully reinstating Big Hill after mining to remove long term visual amenity and safety concerns and protecting high value box ironbark forest. Additionally, SGM has committed to a number of leading practice management and mitigation measures (refer to Table ES 1) in recognition proximity of the Project to sensitive land uses and the need to mitigate potential impacts accordingly.

Evaluation Approach

The Scoping Requirements require that preparation of the EES should be consistent with:

- a **systems-based** approach informed by an understanding of the relationship between different aspects of the proposal and between different aspects of the environment
- a **risk-based** approach that identifies and evaluates potential hazards and their likelihoods, and therefore the level of investigation necessary to assess impacts and inform the need for action to mitigate each risk.

To address the Scoping Requirements, this EES considers all aspects of the proposal and all potential impacts as an inter-related system, including an assessment of interactions between different Project elements and the environment. The systems-based approach adopted also considers different time-frames of response in different components of the system, including short, medium and long-term impacts.

Statutory Assessment and Approvals Process

On 23 April 2013, the Victorian Minister for Planning advised CGC that an Environment Effects Statement (EES) would be required under the *Environment Effects Act 1978*. The Department of Transport, Planning and Local Infrastructure (DTPLI) convened a Technical Reference Group (TRG) of relevant agency representatives to guide development of the EES.

The EES responds to the scoping requirements issued by the Victorian government and provides members of the public, government agencies and regulatory authorities with an understanding of the potential environmental impacts of the Project.

The Project also requires various separate approvals under other relevant pieces of legislation, including:

- an approved Work Plan Variation and Authority to commence works from the Department of State Development, Business and Innovation under the Victorian *Mineral Resources (Sustainable Development) Act 1990*
- approved Cultural Heritage Management Plan under the provisions of the *Victorian Aboriginal Heritage Act 1995*
- permits for the damage or disturbance of any Heritage Inventory sites protected under the *Heritage Act 1995*
- authorisation to take and/or disturb flora or wildlife under the *Flora and Fauna Guarantee Act 1988* and *Wildlife Act 1975* respectively.
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Existing Conditions
The Project area (excluding Mt Micke) is bound by Crowlands Road to the north, Leviathan Road to the east, Albion Road and Fisher Street to the west and Main Street to the northwest. The site is located less than one kilometre from the Stawell CBD and is incorporated within the existing SGM mine licence area (MIN 5260). SGM has operated a large underground mining operation at the site for more than 30 years with attendant above ground infrastructure including a processing plant and TSF.

Mt Micke is an existing waste rock stockpile from the previous mining of the Wonga Pit, located to the south-east of Big Hill.

The bulk of the proposed mining activity for the current Project would be undertaken in the area known as Big Hill, a ridgeline which rises 40−50 metres above the township of Stawell. Big Hill is a modified environment which has been the subject of historical mining activities. The hill is characterised by mining relics, including pits and shafts, scattered vegetation, historic heritage sites and public infrastructure. Three sealed roads provide access to the summit where views of the Grampians and surrounding areas are obtained. Big Hill is used by local residents for recreational pursuits and by visitors to the area seeking views of the Grampians and surrounds. Surface water runoff from Big Hill is currently collected in existing water reservoirs to the northeast or open drains along Scenic Road to the southwest.

The local groundwater table in the vicinity of the Project is located well below the areas proposed to be mined, having been depressed significantly by dewatering activities relating to the underground mining which has been undertaken at the site over the past 30 years.

The vegetation type throughout the Project area is Box Ironbark Forest and is highly modified, either through historic logging and mining activities or current recreation uses. As a result, vegetation conditions have been assessed as ranging from poor to very good condition.

Project Alternatives
SGM has considered several alternative approaches to various aspects of the Project during the design and development process. As a result, a number of refinements have been identified, which result in reduced mining time frames and a reduction in potential impacts of the Project.

The key alternatives considered included various pit shell designs; mine extraction sequencing; noise and dust abatement and mitigation measures; operational and environmental management practices; and material movement options (refer to Chapter 5 for more details in relation to these and other alternatives considered by SGM).

The proposed Project design also addresses the key concerns raised by the Independent EES Panel and the Minister which resulted in the 1999 Big Hill proposal being rejected.

Project Description
The Project involves the open cut mining of two pits (North and South Pit) along the Big Hill ridgeline.

The ore body will be mined in an open pit, top down sequence, with two distinct methods applied: the first one of free dig and the second drill and blast at greater depth. The mining sequence of each pit will be in a cutback style with multiple benches in operation. This will reduce activity on the upper bench to a practical minimum assisting with noise and dust control.
Existing processing plant will be used to process ore recovered by the Project. It is a conventional gravity/leaching process. The carbon in leach circuit allows concurrent leaching (using cyanide) of the gold and adsorption of the gold onto activated carbon which can then be recovered by stripping. Once the gold is stripped from the carbon, the resulting gold sponge is smelted on site to produce gold bars.

Tailings from the processing plant will be transferred to the existing tailings storage facility (TSF No. 2), located approximately three kilometres southwest of the plant. This facility has an approved work plan to operate, which includes approval to increase the wall heights an additional three metres. The additional lift will be required should the Project proceed, but is not part of the scope for this EES due to its existing approvals.

All waste rock generated by the Project will be stored at the TWRS located on land owned by Grampians Wimmera Mallee Water (GWMW) adjacent to the proposed South Pit and then used to backfill the pit voids. The proposed TWRS will be up to 50 metres high at its peak for a period of less than 2 years and then progressively reduces to original topography as the waste rock is placed as part of the rehabilitation process. Leviathan and Reefs Roads are the main access roads to the current SGM operations and this will remain the case for the Project (refer Figure 8-7 in Chapter 8.14). It is not proposed that any changes or additional access points to the mine will be required for the Project. The northern portion of Reefs Road will be closed to the public and removed prior to mining works commencing.

A number of existing community assets/infrastructure will be relocated or protected to allow the Project to proceed as follows:

- **Historic monuments and memorials** will be temporarily relocated or stored for the duration of the Project and reinstated on Big Hill at the conclusion of the Project where feasible
- **Communications tower and fire watch building** will be relocated to the existing SGM stores area located approximately one kilometre southeast of the current tower location due to the risk of instability to the structures during mining and rehabilitation
- **AARNet fibre optic cable** will be relocated prior to the commencement of mining works
- **Sewer line** to 206 Main Street will be temporarily decommissioned until completion of the mining and backfilling of North Pit (18 months)
- **Water infrastructure** will be temporarily taken offline due to its proximity to the North and South Pits with temporary infrastructure ensuring continuity of potable water supply to residential and commercial properties in Stawell.

Backfilling and rehabilitation of each pit is scheduled to commence immediately following removal of the last ore. The placement of different types of fill material and compaction method has been designed to ensure the stability of the reinstated landforms. The TWRS will be utilised for the duration of the Project, but will be at its maximum height for less than two years.

Rehabilitation of the Project area will leave a final landform that is visually compatible with the existing Big Hill landscape; is stable; will not erode, and provides an adequate substrate for vegetation establishment and growth.
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Mining operations will occur over a 12 hour day shift on Monday to Friday with noise generating activities restricted to 7am–6pm. Work outside of these hours will be limited to environmental management and maintenance activities including maintenance of equipment, roads, TWRS, pit batterers and void management activities.

Community Consultation Process

SGM has conducted a comprehensive program of community communications and engagement for the Project focussed primarily on the Stawell community and relevant interest groups. The overall goal of the community consultation process is to effectively engage with stakeholders in an open and transparent manner to ensure they understand and contribute to the Project outcomes.

An EES Consultation Plan is required under the Environment Effects Act 1978 in order to demonstrate how SGM intends to inform the public and consult with stakeholders during the preparation of the EES. The EES Consultation Plan developed during the preparation of this EES was reviewed and endorsed by the TRG.

The EES Consultation Plan sets out the engagement and communication tasks undertaken as part of the preparation of the EES. All of the issues raised during the comprehensive stakeholder communication and engagement process have been used to inform the EES technical studies, as key input to the Social Impact Assessment and in the development of mitigation measures that address community issues and concerns.

Environmental Impact Assessment

Flora and Fauna

The vegetation type throughout the Project area is defined as Box Ironbark Forest and is highly modified, either through historic logging and mining activities or current recreation uses. As a result, vegetation conditions have been assessed as ranging from poor to very good condition.

Nationally significant flora and fauna species that have previously been recorded in the local area (within 10 kilometres of the study area) include:

- 11 flora species, including several orchid species
- 14 fauna species including the Swift Parrot (*Lathamus discolor*).

No nationally significant flora or fauna species or ecology communities were recorded within the study area during any of the surveys undertaken as part of the Project.

A total of 21 state significant fauna species have previously been documented in the local area, of which two were recorded during field surveys. These were the Brown Treecreeper (*Climacteris picumnus victoriae*) and the Bearded Dragon (*Pogona barbata*). Given previous records and the quality of habitat present within the study area, the Brown Treecreeper is likely to regularly visit and forage within the woodland patches. The area surrounding the access road to the stores area represents the best remaining 50 per cent of habitat for the Bearded Dragon, of which only 0.67 hectares will require removal as a result of the Project, leaving this patch mostly intact.
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A total of 46 state significant flora species have previously been recorded in the local area, of which the Small-leaf Goodenia *Goodenia benthamiana* was recorded during field surveys. However, this species was only recorded at one location within the study area, along an artificial embankment adjacent to the storage yard. Given the lack of other records of this species within 10 kilometres of the study area, this record is considered an outlier.

Clearing of native vegetation for the Project will result in the clearance of approximately 15.7 hectares of native vegetation, which will require offsets to meet SGM’s commitment to achieving ‘no net loss’. SGM will meet the requirements of Victoria’s *Permitted clearing of native vegetation – Biodiversity assessment guidelines*, which guide decision making about the biodiversity impacts of removing native vegetation to ensure no net loss of native vegetation in Victoria.

Cultural Heritage

A Cultural Heritage Management Plan (CHMP) must be prepared under Section 49 of the *Aboriginal Heritage Act 2006* when an EES is required. A Notice of Intent to prepare a CHMP was submitted to Aboriginal Affairs Victoria on the 13 June 2013 and the completed CHMP has been submitted to the Office of Aboriginal Affairs Victoria (OAAV) for approval (in lieu of a Registered Aboriginal Party).

A search of the OAAV Victorian Aboriginal Heritage Register revealed that there are no previously recorded Aboriginal Places, with parts of the area having been subject to archaeological surveys on at least three occasions. The lack of available fresh water in the vicinity, the rocky outcropping nature of Big Hill and the presence of more resource rich areas suggests that Big Hill was not a focus for Aboriginal occupation.

A survey of the activity area confirms that widespread, historic mining activities are likely to have completely destroyed the integrity of Aboriginal archaeological deposits within most of the activity area and, as a result, there is little potential for Aboriginal sites within the survey area.

As a result, the CHMP makes no specific recommendations for the management of Aboriginal cultural heritage within the activity area. However, SGM have developed a contingency plan in the event that Aboriginal cultural heritage is discovered during the Project, which is included as part of the Environment Management Plan.

Historic Heritage

Stawell was first settled by European pastoralists in the late 1830s, prior to the discovery of gold in the area in 1853. Gold mining, both alluvial and reef mining, has been undertaken intermittently since this discovery.

Over time, the community of Stawell recognised the importance of Big Hill in its history and a series of memorials and monuments were added to its summit and flanks, beginning with the Pioneers Memorial Rotunda, constructed at the lookout and opened in 1938.

A search of relevant heritage registers revealed no previously identified nationally significant heritage listings and three sites included on the Heritage Inventory, which are partially located within the Project area and have legislative protection, namely:

- Big Hill Mine Site
- Stawell District Memorial - partially overlaps the footprint of the proposed North Pit
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- Scotchmans & Sloane Co - covers a large area of land which includes the proposed North and South Pits as well as the temporary waste rock stockpile and the haul road

Current listings have assessed the significance of the sites as ‘locally significant’.

A field assessment of the activity area identified 15 historic heritage sites/features, comprising a mix of monuments and memorials and mining-related archaeological relics. Of these sites:

- three sites fall outside the Project area
- four historic memorials will be removed for the duration of the Project and reinstated in consultation with Northern Grampians Shire Council (NGSC)
- two sites (Moray graves and engine beds) are located outside the pit areas and will be protected from Project activities
- five sites will be destroyed as a result of the Project
- one site will be partially destroyed by the Project.

The Heritage Inventory listing of the Big Hill Mine Site has been updated to include all the archaeological features and landscapes identified during the historic heritage assessment in order to facilitate their future management via Heritage Victoria’s Consent process.

A photographic record of the six sites to be destroyed will be undertaken to record the history of the area and make it accessible to the Stawell community. Additionally, appropriate action will be taken should any potentially significant historical or archaeological remains be identified during the Project.

Noise

The noise environment surrounding the Project area is characterised by several ambient noise sources including; local and highway traffic, local industries (including existing SGM activities) and commercial sites, schools and community activity and wildlife (insects and birds).

Historically, dwellings in close proximity to SGM activities have been exposed to noise from the mine which has been operating at its current site for more than 30 years.

In accordance with the Noise from Industry in Regional Victoria (NIRV) guidelines published by the EPA, the existing daytime noise limit (50 decibels) will continue to apply to areas that have been previously exposed to noise from SGM operations (e.g. residents in proximity to the existing SGM site) while a target of 46 decibels will apply to residents in others areas during the daytime.

A 3D noise model was developed using proprietary noise mapping software (SoundPlan v7.2) to calculate noise levels expected during the Project. The model makes a conservative assumption that the receiver is always downwind of the noise source.

Due to its proximity to local residents, best practice noise mitigation has been incorporated into the Project design. This includes restriction of operating hours, optimised design of noise bunds and benches for noise management, the sequencing of mining from the south and east of each pit to retain maximum topographical screening and equipment selection. Roads have also been designed to minimise the need for vehicles to reverse and vehicles will be fitted with ‘smart alarms’ or broadband reversing beepers.
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Noise levels are not expected to exceed 50 decibels in residential areas in proximity to the existing SGM site. For the most part, there will be only isolated incidences of noise exceeding 46 decibels (but remaining below 50 decibels) at other receptors. This is with the exception of Quarter 8, when a compactor will be working at relatively high elevations to reinstate the North Pit area which results in a larger number of exceedances from the guidelines. However, NIRV makes provision for the regulatory authority to permit higher noise levels from rehabilitation activities such as that proposed in the final stages of the North Pit rehabilitation.

Blasting
The material in the lower 15 metres of the North Pit and the lower 30 metres of the South Pit (approximately eight per cent of the pit volume) is too hard to be economically extracted using earth moving equipment and blasting will be required. Blasting may occur in the North Pit during Quarter 5 and 6, and in the South Pit during Quarters 11, 13 and 14. Blasting will occur up to once a day during these periods. SGM will provide advance notification to residents who wish to be alerted.

The potential impacts of blasting include ground vibration, air vibration (airblast) and flyrock.

The blasting assessment undertaken as part of the EES process determined that compliance with guideline levels for ground vibration (five millimetres per second) can readily be achieved using a standard blast or a specially designed blast in which the charge mass is reduced. The study has also shown that the proposed blasting associated with mining activity will generate vibration well below the levels known to cause damage to property or infrastructure.

It is expected that ground vibration from blasting in an open cut mine will be less noticeable than underground blasts used in current underground mining operations, due to the shorter duration.

With respect to airblast, the assessment showed that compliance with regulatory requirements was readily achieved at all residential properties with the use of standard or specially designed blasts.

Flyrock can also be contained within the mine boundary, to ensure there is no risk to people or property.

A blast management plan will be developed as part of the Environmental Management Plan, which describes responsibilities, blast design process, monitoring and performance evaluation.

A key element of the Plan will be monitoring of ground vibration, airblast and flyrock during mining so that, if required, modifications can be made to the blast design to ensure compliance with the relevant regulatory requirements.

Air quality
Modelling of predicted particulate emissions was undertaken for Years 1, 2 and 5 of the Project, as these are the years of greatest material movement when potential emissions are likely to be highest. Modelling was based on air quality data from an EPAV air monitoring station in Bendigo in the absence of sufficient site-specific data for Stawell being available. This data is considered to be representative of that expected at Stawell based on comparisons with Stawell background data collected to date.

The air quality modelling assessment has predicted exceedances for some of the air quality indicators at several receptor locations near to the Project area, particularly on days when weather conditions are conducive to dust generation.
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An analysis of the contribution of particulate matter generating sources to the overall predicted dust loading has indicated the majority of sources are associated with active mining operations e.g. hauling, excavating, loading/unloading rather than non-active sources (e.g. exposed areas and stockpiles). This enables SGM to actively manage its major dust generating sources through an integrated Air Quality Management Plan that incorporates an ambient air quality monitoring program, best practice management measures, planning tools such as a forecasting meteorological system, hierarchal control through the implementation of trigger response levels and ultimately intervention by SGM through the reduction or cessation of operational activity during periods of high background (non-mine related) particulate matter concentrations (e.g. dust storms, controlled burns and bushfires).

Greenhouse Gas

Evaluation of the potential GHG emissions resulting from the Project demonstrate that it will trigger the National Greenhouse and Energy Reporting Act 2007 reporting threshold of 25 kilotonnes of carbon dioxide equivalent (kt CO2-e) for Years 1-4 as is the case with the existing operation.

An iterative Project design process has incorporated a number of mitigation measures that will reduce GHG emissions resulting from energy consumption and improve uptake of GHG emissions by vegetation when compared with the concept at Project inception.

Emissions that could result from mining and rehabilitation activities were modelled and presented for the proposed Project. It is estimated that 161.5 kilotonnes CO2-e of total GHG would be emitted and approximately 919.9 terajoules of energy consumed over five years of the Project compared with the ‘no Project’ scenario.

When compared with the existing operation, the total GHG emissions averaged over the five year life of the Project represent a 67 per cent reduction in annual GHG emissions, and the total consumed energy represents a 59 per cent reduction in annual consumed energy.

Geotechnical

Waste rock generated during excavation of the proposed pits will be made up of the natural in-situ rock in various weathering conditions. Testing indicates that the soils have low plasticity, very low swelling and shrinking potential and compaction characteristics that are not significantly impacted by moisture content. However, some soils within the pit area have a high potential for erosion and dispersion.

Detailed three dimensional modelling suggests that the North and South Pit overall slopes will remain stable, with a high factor of safety for both pits. There is a fault zone in the western wall of the North Pit, which dips towards the northeast. As a result, some localised collapse of voids in and beneath the pit walls may occur and that this will affect pit wall stability on a small scale. However, influences are unlikely to extend beyond the pit boundaries. Localised collapse within the mine area will be managed as an operational hazard.

All buildings and critical infrastructure surrounding the pits fall outside the likely horizontal strain and angular distortion damage limits suggested by the Society of Mining Engineers, so are unlikely to be affected. Monitoring will however be carried out throughout the Project to confirm that this is the case.

Two-dimensional stability analyses suggest that the final rehabilitated of Big Hill landscape will be very stable with a high factor of safety. The results also show that large scale failure of the TWRS is extremely unlikely.
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Due to the Project design, there is effectively no risk of longer term mine slope instability and degradation, as the pits will be backfilled at closure.

Residual risks associated with mining operations and surrounding infrastructure will be managed via regular monitoring and review and development of a Ground Control Management Plan.

Potable Water

The Stawell water supply infrastructure is located on the northern slopes of Big Hill, adjacent to the Project. These assets include three raw water supply open storages (water storage reservoir numbers 4, 6 and 7), three potable water supply tanks (tank numbers 1, 2 and 3), potable and raw water supply pipework and associated water supply infrastructure.

A number of the water supply assets will be taken offline during the Project to ensure the stability of the pit areas. Alternative supply and storage arrangements developed in conjunction with GWMWater will be implemented if the Project proceeds to ensure continuity of water supply and quality to the Stawell community.

While the raw water storage capacity of GWMWater’s infrastructure will be reduced, supply will be maintained via pumping of additional raw water from Lake Fyans if required. Adequate potable water will therefore be available to meet the requirements of the Stawell township during the Project.

Additionally, dust deposition modelling showed that the expected turbidity and heavy metal levels expected in the water storage reservoirs during the Project are well within the capacity of the AquaTower Water Treatment Plant.

Surface water run-off will be managed such that it is contained within the Project area while the potential for material from the TWRS to enter the adjoining water storage reservoir has been mitigated by the factors of safety used in the design of the TWRS and the buffer distance between the toe of the stockpile and the reservoir. On this basis, release of contaminated runoff or waste rock to GWMWater water storage reservoir number 7 is considered to be highly unlikely.

The design and mitigation measures incorporated as part of the Project mean potable water quality and potable water supply to the Stawell township will not be impacted by the Project.

Surface Water

The surface water run-off from Big Hill flows naturally towards the northeast and is either collected in GWMWater reservoirs or conveyed via open channel drains adjacent to the reservoirs. Surface water from the south-western section of the Project area is collected in existing open drains along Scenic Road. An existing retarding basin owned by NGSC is also located at the corner of Albion Road and Duke Street.

Surface water management measures undertaken during the Project have been designed to contain run-off for up to a 100 year average recurrence interval storm event. Run-off from disturbed areas will be contained within the Project area and reused for dust suppression and ore processing, so that additional raw or potable water will not be required from GWMWater.

As the landform is reinstated, standard construction erosion and sediment control techniques will be employed to ensure contaminated run-off is contained within the site. Vegetated cut-off drains and sedimentation basins will convey and capture surface run-off which will be pumped to SGM water storage dam one as required.
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Following rehabilitation, the vegetated drains and sediment basins will remain in place until vegetation is established and water quality treatment is no longer required. Stormwater management controls (channels and basins) will similarly remain in place until vegetation is established on the rehabilitated pit areas and the water quality is tested to ensure that the run-off from revegetated areas is of similar or better quality to that of the surrounding natural run-off.

Groundwater

Approximately 200 exploration drill holes were drilled along the Big Hill ridgeline in 1999 to depths in excess of 120 metres below the crest (~180 mAHĐ) of Big Hill, all of which were reported to be dry. This data together with the known elevation of underground mining (and therefore dewatering level) suggest that groundwater levels beneath Big Hill and the ridge line south are currently significantly below the proposed base of North and South Pits.

Given the extent of dewatering undertaken beneath the Project site and the relatively low permeability expected of the bedrock aquifer, it is likely that the recovery (rebound) of groundwater to pre-mining levels will take at least 30 years (i.e. as long as dewatering activities have been undertaken). As such, it is unlikely that the pits will intersect with the groundwater; consequently there is no potential for the pits to act as a groundwater sump and reduce the flows of groundwater into the regional system.

As groundwater levels recover to pre-mining levels, it is unlikely that groundwater will come into contact with the waste rock used to backfill North Pit but in the deeper South Pit, there is potential for recovered groundwater levels to intersect with backfilled waste rock. However, the majority of waste rock used for backfill is not leachable for metals and is unlikely to materially affect groundwater quality from either rainfall infiltration or interaction with the water table. The small known amounts of waste rock with the potential to become acidic will be encapsulated within the non-leachable waste rock and placed at locations where there is no potential for intersection with groundwater in the future.

Waste Rock

Mining of the North and South Pits is estimated to produce approximately 7.8 million tonnes of waste rock material that will be stored temporarily at the TWRS, before being used to backfill the pits or used directly as backfill for the North Pit.

In terms of the geochemical aspects of the waste rock generated by the Project, the key impacts relate to the potential for acid generation, saline and/or metaliferous run-off or seepage to groundwater. The majority of waste rock tested shows it to be non-acid forming, and exhibiting relatively benign characteristics due to the low to very low total sulphur content.

The highly weathered nature of the waste rock and the neutralising capacity of its mineralogy mean it can be classified as non-acid generating (NAG). The testing also shows there is minimal risk of leaching saline or elevated metal run-off or seepage water. The minor volumes of rock where there is some potential for acid and/or saline will be detected by the waste rock validation program, segregated appropriately and managed to ensure any leaching is contained. There will be a waste rock management plan as a part of the work plan, which will include this validation program.
Traffic and Transportation
The Project will generate only minor changes to traffic volumes on the existing road network surrounding the Project area. The overall number of employees for the Project (and hence employee traffic) is lower than that associated with the current underground mining operations and the majority of traffic generated by the Project occurs only within the mine boundaries. It is only during the rehabilitation stage (Year 5) when waste rock may be transported from the Mt Micke / Wonga Pit area to the South Pit that haul trucks will be required to cross a public road (Albion Road). Measures have been proposed to significantly reduce any risks associated with this.

As such, potential amenity impacts caused by mine traffic on public roads will be minimal.

The impact of mining traffic on the performance of the road network has been assessed and is considered to be minimal. The impact of the Project on the performance of intersections is not significant and most do not require mitigation. All intersections assessed are well within capacity limits in terms of traffic volumes.

Mining traffic is not expected to impact on public transport and freight routes and does not necessitate any specific mitigation measures.

Visual and Landscape
Big Hill is a highly modified landscape due to 19th century mining activity which has resulted in inconsistent tree cover and a degraded surface in some area. A number of disparate structures are located on Big Hill. From most vantage points in and around Stawell township, views of Big Hill are framed by the urban environment with houses, commercial premises and utilities generally visible in the foreground.

The view from Big Hill to the west provides an excellent view of the township and the Grampians beyond, which is highly valued locally.

The Project will result in short- to medium-term impacts on the view of Big Hill. However, the overall visual impact will be reduced, as the ridgeline of Big Hill will remain intact to a large degree throughout the Project, the main visual impacts being the exposed surface of the pits during mining.

The visual impact assessment identified three locations in and around Big Hill and the Stawell township where the scale and extent was rated as a high level of visual impact but noted that the impact was short term due to progressive rehabilitation of the mined areas.

The overall visual impact of the Project is further reduced by the progressive rehabilitation of the site as mining progresses. The North Pit will be fully mined in Year 2 and reinstated up to three years ahead of the Project finish.

The proposed relocation of the communication and fire towers will have a lesser, but permanent impact on the visual landscape as they will remain in their new locations. In terms of visibility, the relocated towers will have less overall impact than in their current location at the summit of Big Hill although they will be highly visible from several locations.

It is recognised that the visual relationship between Big Hill and the Stawell community is multi-faceted and important. Community consultation undertaken as part of this EES suggests that the ‘iconic’ value of Big Hill is important to the community but there is a recognition that the current environment is considerably degraded. The ultimate return of Big Hill to its original landform means any loss of the ‘iconic’ values is temporary.
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The reinstatement of the Big Hill landform and the proposal to develop a rehabilitation and end-use master plan with community input provides an opportunity to create a rehabilitated Big Hill in an improved condition to that presently existing and with a range of enhanced community facilities and assets.

Health

While the Project is unlikely to result in significant negative health impact on the community generally, the potential for increased exposure to respirable dust in the surrounding areas did require further consideration. This was due to atmospheric modelling of respirable dust emissions indicating a potential increase in dust concentrations in areas adjacent to the Project area.

Potential health impacts associated with the Project are generally considered low to very low prior to mitigation measures being implemented, and are considered very low following implementation and maintenance of appropriate mitigation measures.

With full implementation of the real time air quality monitoring program and Air Quality Management Plan, it is expected that on days when background levels are elevated, works at the site are modified or ceased depending on the severity of conditions so that the assessment criteria are not exceeded at nearby residences. If these criteria are not exceeded at nearby residences, the Project will comply with the requirements of the Victorian EPA guidance requiring the protection of health from exposure to respirable dust associated with mining.

The potential for direct health impacts caused by stress and anxiety amongst the impacted communities during the Project due to loss of amenity (acoustic, vibration and visual) is considered to be minor and can be managed through effective consultation and communications.

Economic

Stawell is a medium-sized town which provides a range of government services and retail trade to the immediate region. Mining employs seven per cent of the Stawell workforce, and generates almost $57 million, or 22 per cent, of the economic value that is added to the community, making it Stawell’s highest value industry.

The Project will generate a temporary gain in the form of 286 (100 direct and 186 indirect) jobs and a net welfare gain of $38 million compared to the ‘no Project’ scenario. Stawell’s economy will be a major benefactor with an estimated 4.9 per cent increase in GRP in the investment phase of the Project.

There may be some minor negative effects arising from the Project, primarily as a consequence of sustaining current higher wages which will result in higher labour costs for those industries competing with the mining sector. However, these effects are relatively small and exist currently as a result of the current underground mine.

The Project will effectively extend the duration of gold mining in Stawell for another four years. Without the Project, mining is likely to cease in 2014-15 and local businesses supplying the existing mine will need to adjust. The Project may be beneficial for local businesses and mine employees as it will allow time for those affected to adjust and find alternative employment, either outside mining or in servicing mining operations elsewhere in Victoria or further afield. On balance, it is contended that the proposed positive economic benefits of the Project significantly outweigh the potential negative economic impacts.
Social

At the time of the 2011 Census, the Stawell township was the Northern Grampian Shire’s most populous centre with a population of 5,736 residents. However, the demographic profile of Stawell is of an ageing population that is in overall decline leaving the township vulnerable to changes which undermine the local economy, community services, schools and sporting clubs. Additionally, demographic indicators place Stawell in the seventh percentile (the lowest seven per cent of suburbs in Victoria) in terms of social disadvantage.

Big Hill is valued by the Stawell community primarily for its historic landscape, as a recreation area and for its panoramic views of the township and the Grampians. While this local landmark is important to Stawell residents’ sense of place, it is also acknowledged as being degraded, and by some, an eyesore.

The retention of population in Stawell and the surrounding district and the contribution that these residents make to the social and economic fabric is the main positive social impact of the Project. This Project also presents a unique opportunity to rehabilitate Big Hill to deliver a site that is more accessible and useable for community purposes at the end of the Project.

However, despite the implementation of the proposed mitigating actions, the Project will generate a number of negative social impacts including the loss of views and access to Big Hill in the short to medium term. During this time, all existing social and recreational activities conducted at Big Hill would need to re-locate or cease.

Concerns about potential reductions in residential amenity and health caused by the Project are common in the community. In this context it is recognised that:

- Noise impacts are projected to exceed regulatory guidelines at a small number of residential properties in Quarter 8. Also, vibrations from blasting could be perceptible on a regular basis. Affected residents may potentially see this as unreasonable/unfair but it is important to note that noise is restricted to daytime operation and blasting is expected to be infrequent and within regulatory limits.

- Fears of the community in relation to health impacts have the potential to cause stress and anxiety. While the proposed mitigating actions will allay these fears to a degree, some may continue to hold fears and perceptions even though the technical studies demonstrate that potential health impacts will be within regulatory limits.

Many in the community will feel a sense of uncertainty regarding Big Hill and its future, until Big Hill is re-instanted.

Best practice noise, dust, blasting and health mitigation measures have been incorporated into the Project design to reduce the social impacts, particularly those likely to be experienced by residents surrounding the Project site. It is considered that these impacts are acceptable in light of the considerable economic benefit to the community for an additional five years.
Executive Summary

Hazard and Risk

As part of this EES, a semi-quantitative method was used to identify, analyse and assess the property and infrastructure; environmental; social; economic; and public health and safety risks associated with the Project.

The risk assessment combines the potential negative impacts and risks as identified in the individual technical assessments. These are assessed in terms of comparative magnitude, extent and duration of the impacts and in terms of likelihood of occurrence.

The expected impacts of risks posed by the Project assume that the Project activities and mitigation measures are designed and implemented to appropriate standards.

Known events are those events where prior to project commencement, it can be reasonably certain (likelihood of occurrence is close to 100 per cent) that they will occur over a given time frame. Known events are expected to occur and their impacts are usually discussed in terms of magnitude and permanence.

Three known events are expected to result in a moderate level of impact on the wider environment. These are:

- changed landform (temporary)
- change in land use (recreation)
- noise (perception).

The other nine impacts from known events are considered to be minor or negligible by the subject matter specialists. No major or extreme impacts from known events were identified for the Project.

In contrast, risk events, are events that are not expected to occur over a given time frame, but may or may not actually occur.

A group of technical experts identified a total of 34 risks associated with the Project. Following mitigation, four of these risks were considered to pose a minor risk to the wider environment. The remainder pose negligible risk to social, economic, environmental, property/infrastructure and public health and safety assets within the wider environment.

Of the residual risks (i.e. those which remain following the implementation of management and mitigation measures), the top six risk events are:

- Noise (operational)
- Increased erosion
- Dust (PM$_{10}$)
- Dust (PM$_{2.5}$)
- Stormwater containment failure
- Revegetation survival

Assuming that mitigation and management measures are in place and functioning adequately, all risks are assessed to be negligible, with the exception of from noise resulting from mining activities and the additive risks of PM$_{10}$ and PM$_{2.5}$ dust emissions, which are considered to be minor.
Rehabilitation

Rehabilitation Plan

The Mineral Resources (Sustainable Development) Act 1990 requires mining license holders to develop a rehabilitation plan as part of the Work Plan. Guidance is provided in Rehabilitation plans and other environmental aspects of work plans.

The rehabilitation plan provides the framework under which the Project site will be reinstated following the completion of mining activities. This plan is not intended to include reconstruction of built features. Rehabilitation of the North and South Pits and the footprint of the TWRS will aim to leave a final landform that is safe, stable and sustainable.

The rehabilitation plan will enable the specific end land use to be defined during the Project through further consultation with community, NGSC and the Department of Environment and Primary Industries (DEPI).

Following the successful reinstatement of the landform, an agreed framework of objectives and criteria for rehabilitation and mine closure will be established. This framework will incorporate aspects ranging from physical elements (e.g. stability, drainage, erosion and suitability of materials to support plant growth) through to biological aspects (e.g. vegetation establishment and growth) and post-closure management.

Infrastructure Restoration

The following infrastructure will be reinstated within the Project area following the successful rehabilitation of the landscape:

- **Big Hill Road** is proposed to be reinstated following the completion of mining activities
- **historic monuments and memorials** removed and stored offsite for the duration of the Project will be reinstated at locations to be determined in consultation with NGSC, local community interest groups and other stakeholders
- **GWMWater potable water tanks and reservoirs** will be recommissioned following the completion of mining activities and once the structural integrity of these assets is established
- **GWMWater grazing pasture land** will be rehabilitated such that it is suitable for grazing following the removal of waste rock from the TWRS to backfill the North and South Pits
- **sedimentation basins and drainage lines** established during the Project to manage surface water within the Project area will be in-filled once adequate erosion mitigation measures (i.e. vegetation) is established.
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Master Plan and Future Land Use
The long term strategy for the Project site is for it to be returned as a community asset. The site will be rehabilitated to a safe, stable and sustainable landform by SGM as part of the mine closure process. This rehabilitation process will not preclude any future land uses for Big Hill and surrounding public open space.

It is intended that a master plan would be developed for the rehabilitated Project area should the Project receive approval. This plan would detail the infrastructure and uses to be included on the site, which would be identified in consultation with NGSC, the State Government as appropriate, and the Stawell community.

Environmental Management Framework

Environmental Management Plan
SGM has an existing Environmental Management Plan (EMP) for current operations. The EMP addresses the operational and environmental risks associated with SGM’s operations. The EMP is supported by a range of other documents including an environmental aspect, impacts and risk register; obligations register; and an environmental monitoring program.

An updated EMP will be developed to incorporate the activities to be undertaken as part of the Project.

Environmental Performance and Reporting
Environmental performance evaluation and reporting is recognised by SGM as a key decision-making tool that provides the information required for adaptive management measures and control measures.

SGM has an established environment review committee (ERC) for existing operations. The ERC consists of representatives from SGM, local community, NGSC, DEPI, Department of State Development and Business Innovation, Environment Protection Authority and other relevant government advisory bodies. The ERC would continue to meet quarterly for the duration of the Project.

Conclusion
The Project evaluated in this EES proposes the open cut mining and subsequent full rehabilitation of Big Hill ridgeline. All mining and rehabilitation activities will be completed within 5 years and Big Hill will be returned to its approximate original landform, available for community use. Detailed investigations conducted as part of the EES demonstrate that the Project, with the leading mitigation practices that have been adopted, can achieve compliance with all regulatory requirements except some exceedances for noise despite mining occurring within the EPA-recommended 250 metre buffer separation distance from sensitive land uses.