Project Description

6.1 Introduction

The Ministerial Guidelines for Assessment of Environmental Effects under the Environment Effects Act 1978 (Vic) require proponents to provide a description of the entire project (including associated infrastructure). An analysis of relevant alternatives capable of substantially meeting the Project’s objectives is also required, especially where the alternatives offer environmental benefits or reduced environmental impacts. This chapter provides a description of the development proposed by SGM. A description of the alternative approaches to project design and implementation considered in the course of project definition is provided in Chapter 5.

This section of the EES addresses the following requirements of the EES Scoping Requirements:

‘3.3 Project Description

The EES is to describe the project in sufficient detail both to allow an understanding of all relevant components, processes and development stages, and to enable assessment of their likely potential environmental effects.

The EES should describe the following aspects of the project, to the extent relevant and practicable.

An overview of the proponent, including relevant experience in developing and operating projects as well as its health, safety and environmental policies.

Details of all new project components including:

- location
- footprint and layout
- technical specifications and design capacity
- methods of site establishment and operation.

Other necessary works directly associated with the project, such as road upgrades, infrastructure and services relocation, or augmentation of existing plant and facilities.

The location and arrangements for sustainable use of existing SGM facilities and infrastructure that this project relies upon.

Establish requirements for the sustainable performance of the TSF during its use for the project to ensure on-site containment of all waste substances.

Lighting, safety, access and security requirements.

Information on the project’s operational life, including expected construction timetabling and staging, and decommissioning and rehabilitation arrangements.’


6 Project Description

6.2 Overview

All activities associated with the Project will take place within MIN5260, a mining lease granted by the Victorian Government in 1985 to Leviathan Resources Ltd (now held by Crocodile Gold Corporation).

The Project involves a move from current underground ore recovery to open cut mining of two pits (North and South Pit) utilising the existing ore processing and tailings management facilities over an approximate five year timeframe (including rehabilitation). At the completion of the Project the mined areas will be reinstated to a similar height and shape to the current landform.

The key elements of the open cut mining will be on a ridge line known as Big Hill, which lies immediately to the east of Stawell, and north of the current SGM operations. Big Hill is publicly accessible Crown land which is currently occupied by a number of community assets (refer to Section 6.5).

Leviathan and Reefs Roads are the main access roads to the current SGM operations, and this will remain the case for the Project. 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 (Figure 6-1).
Figure 6-1  Big Hill Enhanced Development Project in the context of existing SGM operations
6 Project Description

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6.3 Project Components

The Project consists of eight key component areas, include areas required for ancillary activities, including, vehicle access and water management. These are summarised in Figure 6-2.
6 Project Description

A detailed schedule and outline of the sequencing of the Project are provided in Section 6.4 (below). The following gives a description of the key Project components:

**North Pit**

The North Pit is located southwest of Main Street and northeast of Fisher Street predominantly within reserved and unreserved Crown land, including the area known as Big Hill.

The North Pit (6.3 hectares) will be mined first to a depth of 95 metres below the highest point of Big Hill, and approximately 60 metres below Main Street.

Mining of the North Pit will not impact the existing ridge line and peak of Big Hill (i.e. the current location of the communications tower and fire watch building). Additionally, mining of the the eastern side of the ridgeline will be minimal, leaving views of this area largely unchanged.

**South Pit**

The South Pit is located to the northeast of Fisher Street and is largely located in the area between Scenic and Reefs Roads, on unreserved Crown land. It includes the former Davis Pit.

The South Pit (13.6 hectares) will be mined following completion of ore recovery from the North Pit to ensure continuation of supply to the processing plant. The South Pit will be mined to depth of approximately 90 metres below the ridge, and approximately 60 metres below Fisher Street.

Over 50 per cent of the South Pit area is within the current SGM fence line and therefore not accessible to the public.

**Temporary waste rock stockpile (TWRS)**

All waste rock from the Project will either be temporarily stored at the TWRS or used to commence backfilling of the adjacent pit.

The approximately 20 hectares footprint of the TWRS is located east of Reefs Road and immediately south of GWMWater water storage reservoirs 6 and 7. At its maximum height, the TWRS will be approximately 50 metres above the natural surface, and comprise two 20 metre lifts and a 10 metre lift.

The TWRS footprint incorporates land previously used for the Davis Pit (mined during the mid-1980s) overburden dump (unreserved Crown land) as well as cleared pasture land currently owned by GWMWater. The TWRS facility will not exist at the completion of the Project, with all waste rock being required for site rehabilitation. Following the removal of all waste rock from the TWRS to backfill the North and South Pits, land currently owned by GWMWater and leased for grazing purposes will be reinstated such that it is suitable for this use.

**Haul road**

The haul roads for the Project run from the south eastern edge of the North Pit to the northern edge of Mt Micke, in a generally north-south alignment. The haul road uses portions of Reefs Road in the north and Albion Road to the south. Additionally the northern section of the haul road has been has been constructed within the final footprint of the South Pit to minimise vegetation clearance.
6 Project Description

The entire haul road network to be utilised for the Project amount to approximately 2.1 kilometres which results in a 4.1 hectare footprint. 40 per cent (830 metres) of the linear length comprises existing roads.

**Communications and fire watch tower**
In order to minimise the risk posed by open cut mining to the existing fire watch tower and communications tower, both of these structures will be relocated.

The stores area for the current mining operations has been selected as the site for co-locating both the communications and fire watch towers, which is acceptable to the operators of the facilities. It is proposed that the site will be connected to Albion Road via an existing access track upgraded for this purpose.

**Sediment basins and drainage channels**
A number of relatively small sediment basins, open drainage channels and a flood storage basin will be constructed around the North and South Pits to manage runoff from the Project area following the completion of mining operations and prior to the re-establishment of vegetation.

The entire drainage network proposed to manage runoff totals approximately 1.7 hectares, and will be installed as part of the early works to allow vegetation of the disturbed ground prior to backfilling and re-establishment of Big Hill profile (backfilling of voids).

**Mt Micke**
In order to fully backfill the North and South Pit voids, additional waste rock from that generated during the Project is required. It is proposed that approximately 500,000 cubic metres of waste rock from Mt Micke, located 1.5 kilometres south of the South Pit, will be utilised for this purpose or a suitable alternative.

Mt Micke is an existing waste rock stockpile generated from the mining of Wonga Pit in the early 1980s.

6.4 Project Schedule
The overall time period expected to complete the mining component of the Project is approximately four years (Table 6-1). Another 12 months will be required to complete the backfilling and rehabilitation of the South Pit with the North Pit being backfilled and rehabilitated during mining of South Pit.

Mining of South Pit will commence as soon as North Pit ore is exhausted to ensure continuation of supply to the process plant. Waste rock mined from South Pit will preferentially be used to backfill North Pit rather than temporality stored at the TWRS.
### 6 Project Description

#### Table 6-1 Big Hill Enhanced Development Project schedule

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
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<td>Excavation of South Pit, with placement of waste rock at TWRS</td>
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<td>Excavation of South Pit, with reinstatement of the North Pit void using waste rock extracted from the South Pit</td>
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<tr>
<td>Placement of TWRS waste rock into the South Pit voids</td>
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<tr>
<td>Placement of Mt Micke (or suitable alternative) into remaining pit voids and rehabilitation of South Pit</td>
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</tbody>
</table>
6 Project Description

6.4.1 Scheduled Project Activities

**Pre-Mining**

Prior to any mining works commencing the following pre-mining activities will have been completed:

- infrastructure relocation/management including (details provided in Section 6.5)
- construction of security fence
- mobilisation of mining equipment
- vegetation clearance
- pre-stripping and stockpiling of topsoil and subsoil from the pit areas
- preparation of TWRS area
- decommissioning of Big Hill Road, Scenic Drive and northern portion of Reefs Road
- construction of haul road and stores area (communication and fire watch tower) access road.

**Quarter 1**

Mining will commence in the North Pit, cutting in from the southeast corner of Big Hill along the proposed haul road route. This will allow the excavator to be located at approximately 295 metres AHD and to excavate down to approximately 290 metres AHD, or 10 metres below the crest of Big Hill (Figure 6-4 and Figure 6-5). This means that residents to the north and west of the Project will be shielded from excavation and loading activities, greatly reducing noise and dust impacts.

In addition to mechanical excavation, some ripping by bulldozer will likely be required due to the hard nature of the capping material on Big Hill. Any ripping will follow the contours around the south eastern corner of Big Hill to maintain the shielding effect.

As mining progresses across the top of Big Hill, additional benches will be created at lower levels to ensure residences are shielded from mining activities, containing noise and dust emissions. The final extraction of the outer portion of each bench will only occur once at least two 5.0 metre benches have been established below. This will ensure the dust and noise are minimised at all times.
6 Project Description

Figure 6-3  Project area showing location of cross sections

Figure 6-4  Cross section North Pit Quarter 1, looking north
6 Project Description

The TWRS area will also be established during Quarter 1, with perimeter drainage, sediment dams and storm dams constructed (Figure 6-6). Topsoil clearing and stockpiling of material between the TWRS and sediment dam will also be completed.

Stock piling of waste rock at the TWRS will commence in Quarter 1. Initially waste rock material will be used to create a 5 metre high noise bund along the north and eastern boundary of the TWRS. The eastern section of the stockpile will be built up and the noise bund in this area increased by one lift by the end of the quarter.

Approximately 50,000 cubic metres of highly siliceous material will be stockpiled separately in the south western section of the TWRS. This material is less likely to result in erosion and will be used for placement on the outer surface of the reconstructed Big Hill prior to topsoil placement.

To reduce both noise and dust emissions from the TWRS, the outer section of the stockpile will be constructed first. This will involve paddock dumping along the outer edge, with this material then being pushed up with a bulldozer to form a bund. More material will then be placed on the inner side of this bund and again pushed up with a bulldozer. This process will continue until the outer edge is approximately five metres higher than the TWRS floor, at which point waste material placement will occur behind the noise and dust attenuation bund.

The floor level of the TWRS is expected to increase in height by approximately two metres for each completed paddock dump over the footprint. In order to maintain the full benefit of noise and dust shielding the outer bunding will be raised first with each successive lift of the TWRS.
A 1.8–2 metre high bund will be maintained around the toe of the TWRS to ensure containment of any run-off to the Project area.

**Quarter 2**

Mining in the North Pit will continue with the same method as Quarter 1 with an outer bench being maintained above the operation. By the end of Quarter 2, the operating area of the pit will cover approximately 60 per cent of the final pit area. The second stage of land clearing and top soil removal of the North Pit will occur at the end of Quarter 2.

By the end of Quarter 2, the maximum TWRS height will not have increased, but around half of the surface area will be increased by one level and the noise bund will be extended along the southern edge of the TWRS. The quantity of material stockpiled separately for subsoil re-establishment will be approximately 100,000 cubic metres.

**Quarter 3 and Quarter 4**

The entire surface area of the North Pit will be excavated early in Quarter 3 and mining will continue below what is the final pit crest for Quarter 3.

The upper section of the final pit wall for the entire circumference of the North Pit will be completed by the end of Quarter 3 and a full geotechnical review of the exposed pit walls will be conducted.

Mining during Quarter 4 will extend the pit to approximately 250 metres AHD, which is about midway between the pit crest and pit floor.

The first stage of vegetation clearance will begin in the South Pit area and water reservoir number 6 will be decommissioned in anticipation of mining commencing in the South Pit.

The entire TWRS footprint will be levelled by the end of Quarter 4 and the northern and eastern noise bunds at the facility increased to approximately 5 metres above the height of GWMWater water storage reservoir 7.

**Quarter 5 and Quarter 6**

Mining will continue in the North Pit, with approximately 85 per cent completed in Quarter 5 (Figure 6-7 and Figure 6-8), increasing to 95 per cent completed by the end of Quarter 6.

![Cross section North Pit Quarter 5, looking north](image)
Mining will commence in the South Pit to supplement the reduced rate of ore excavation from the North Pit during Quarter 5 (Figure 6-8).

Figure 6-8  Cross section South Pit Quarter 5, looking north

Mining of the South Pit will be undertaken in two stages (Figure 6-9 and Figure 6-10). Mining activity during stage 1 will be restricted generally to the area east of the former Davis Pit boundary in order to minimise disturbance and shield activity from residences.
6 Project Description

Figure 6-9  Plan view of Project area showing Sout Pit stages 1 and 2

Figure 6-10  Cross section South Pit, looking north, showing stages 1 and 2
6 Project Description

During Quarter 5 and 6, the eastern boundary of the mined area will also be constrained in order to maintain a dual lane haul road into the North Pit.

By the end of Quarter 6 the TWRS bunding will be at approximately 275 metres AHD or 10 metres above GWMWater water storage reservoir 7 (Figure 6-12).

Quarter 7

Mining of the North Pit will be completed and backfilling commenced during Quarter 7 (Figure 6-13). All fill material placed in the North Pit during Quarter 7 will be placed below the pit crest using dump tip heads at around the 245 metres AHD and 265 metres AHD respectively.
6 Project Description

Mining activity in the South Pit will extend to the full stage 1 area during Quarter 7 (Figure 6-14 and Figure 6-15). The haul road to the North Pit will be reduced to single lane access, with an inpit ramp for waste haulage into the North Pit. Mining activity will move from east to west across the South Pit footprint maintaining shielding along the western edge of the pit.

Figure 6-14 Cross section of the South Pit during Quarter 7, looking north

Figure 6-15 Cross section of the North and South Pits Quarter 7, looking east

The TWRS will become inactive during Quarter 7 at approximately 280 metres AHD (Figure 6-16), or 15 metres above GWMWater water storage reservoir 7. All exposed areas of the TWRS will be covered in a crusting surface stabiliser or spray mulched to minimise dust generation.

Figure 6-16 Cross section of the TWRS Quarter 7, looking north

Quarter 8

Mining activity will continue in the South Pit during Quarter 8, with the fill previously placed in the Davis Pit removed and used in the reestablishment of Big Hill. Bulk backfilling in the North Pit will be completed by the end of Quarter 8, with fill horizons below the lower crest of the North Pit.
6 Project Description

The TWRS will remain static during Quarter 8, with a dust suppressant applied to minimise dust generation.

**Quarter 9**

Mining will extend to the full final footprint of the South Pit during Quarter 9, with the stage two pushback commencing. The area of the pit mined up until Quarter 9 will be at a depth of approximately 245 metres AHD.

Reconstruction activity will continue across the North Pit, with paddock dumping methodology introduced. This means fill material will be tipped in place next to piles of previous fill, creating an area ‘paddock’ of fill material. These individual loads will then be bulldozed or graded flat to create the next dump surface. Each paddock lift will be approximately two metres in height and will be highly compacted by the creation of lift above.

This methodology allows multiple levels to be created simultaneously and enables the outer edge of the reconstruction area to be built up first to minimise the length of time equipment is working unshielded. The top layer of the reconstructed landform will be the highly siliceous schists, which were stockpiled separately during Quarter 1 and Quarter 2.

**Quarter 10**

Mining will continue at both the western wall and the base of South Pit concurrently (Figure 6-17).

![Figure 6-17 Cross section of the South Pit, Quarter 10, looking north](image)

The reconstruction of Big Hill will continue during Quarter 10 with 90 per cent of the landform completed (Figure 6-18 and Figure 6-19).

![Figure 6-18 Cross section of the North Pit, Quarter 10, looking north](image)
6 Project Description

Figure 6-19 North and South Pits Quarter 10, looking north

Maintanence of the TWRS will continue during Quarter 10, with no additional material added to the stockpile.

Quarter 11 to Quarter 13

Mining will continue in the South Pit, with mining activity extending to the base of stage one. The stage two zone will be extended to approximately 245 metres AHD or 40 metres above the final pit base. The surface disturbance extent of the South Pit will not increase during the period Quarter 11 to Quarter 14.

The reinstatement of access roads and memorials will commence on the top of the reformed Big Hill during Quarter 11. Water reservoir number 4 will be recommissioned following reinstatement of the North Pit to a condition consistent with an agreement to be established between SGM and GWMWater.

Stockpiling of waste rock at the TRWS will recommence during Quarter 11. The TWRS will continue to increase in height during Quarter 11 to Quarter 13 and as a result of the reduced area available for each lift, the height of the TWRS will increase more rapidly during this period.

Quarter 14

Mining in the South Pit will be completed during Quarter 14 (Figure 6-20).

Figure 6-20 Cross section of the South Pit, Quarter 14, looking north

The TWRS will reach the maximum profile (approximately 50 metres above natural surface) during Quarter 14 as mining of the South Pit is completed (Figure 6-21).

The bund progressively constructed around the perimeter of the TWRS benches will be maintained to allow for controlled removal of material and dust suppression (Figure 6-21).
6 Project Description

Quarter 15 to Quarter 20

All mining activity will be completed by Quarter 15. All activities from Quarter 15 onwards involve rehabilitation of the South Pit, which will continue through to Quarter 20.

The South Pit will be backfilled with material from both the TWRS and Mt Micke (or a suitable alternative) concurrently during Quarters 15 to 20 according to the material properties for different stages of the rehabilitation.

6.5 Infrastructure Relocation and Management

A number of existing community assets/infrastructure (Figure 6-22) will be moved or protected to allow the Project to proceed.
Figure 6-22  Community assets to be relocated
6 Project Description

6.5.1 Historic Monuments and Memorials

Chapter 8, Section 8.4 provides details of all the historic and heritage sites that need to be protected for the project and proposed management and mitigation measures.

It is proposed that, prior to mining operation commencing, the monuments and memorials to be protected will be temporarily relocated or stored depending on the outcomes of consultation with relevant regulatory authorities. Subsequent to mining, the monuments and memorials will be relocated on the reformed Big Hill as described in more detail in Chapter 10, Section 10.3.2.

6.5.2 Communications Tower and Fire Watch Building

The communications tower and fire watch tower located between the proposed North and South Pits will require relocation due to the risk of instability to the structure during mining and rehabilitation.

This infrastructure will be relocated to the existing stores area in the SGM operation located approximately one kilometre southeast of the current tower location. This location was chosen as it is already an area that has been cleared of vegetation and it is the next closest high point to the existing location. DEPI and NGSC were consulted and have approved the stores area location for the new facilities (Figure 6-22).

There is a topographic height difference of 13 metres between the current infrastructure area and the stores area, and as a result, the new communications tower will be constructed to a height of 50 metres to provide the same elevation and coverage as the existing Big Hill tower (336.5 metres AHD). In addition, a raised supporting structure will be constructed to maintain the same viewing elevation for the new fire watch building, resulting in the structure being 15.5 metres in height.

An existing off-road vehicle track will be upgraded to provide vehicle access to the existing stores area and the relocated communications tower and fire watch building. This upgrade will require 0.64 hectares of vegetation removal (EHP 2013) to enable vehicles to access the site. No vegetation removal is required as a result of the relocation of the communications tower and fire watch building themselves.

Power will be supplied to the relocated infrastructure by three-phase overhead power lines, running from Albion Road along the upgraded vehicle access road to the stores area. This infrastructure will be owned and managed by Powercor. A 25 metre clearance is required along the length of these power lines for fire prevention purposes. This will be undertaken using chain sawing and stem injection of trees with herbicide to prevent regrowth.

6.5.3 AARNet Fibre Optic Cable

The AARNet cable which traverses to the north of the Project area will be relocated prior to the commencement of mining works. A new alignment has been developed in consultation with AARNet, as shown in Figure 6-22.
Project Description

6.5.4 Sewer Line
The existing sewer pipeline to 206 Main Street (Figure 6-22) will be temporarily decommissioned until completion of the mining and backfilling of North Pit (18 months).

The pipeline may have to be upgraded following rehabilitation of North Pit as it is Vitrified Clay (VC) and will be replaced with uPVC sewer class pipe with additional inspection openings to be included at residential property 204 Main Street to Lot 18 Fisher Street.

6.5.5 Water Infrastructure
A number of GWMWater assets will be temporarily taken offline due to their proximity to the North and South Pits. The temporary infrastructure needed to ensure continuation and security of supply to residential and commercial properties in Stawell will be installed and operational prior to the commencement of mining works that could potentially impact on existing infrastructure. All temporary works have been developed in consultation with, and approved by, GWMWater.

The assets that are affected by the works for the Project have been grouped as follows:

- GWMWater raw water system
- GWMWater potable water system
- SGM raw and potable water supply.

The relocation of these assets is described below.
6 Project Description

Figure 6-23  Existing water infrastructure
6 Project Description

6.5.6 Raw Water System

Water storage reservoir 7 (Figure 6-23) will remain operational for the duration of the Project, while water storage reservoirs 4 and 6 will be taken offline at various stages during the mining works.

Water storage reservoir 4 (Figure 6-23) will be taken offline first for 18 months (i.e. during the mining of North Pit), to allow the haul road to be constructed along the edge of the storage. All raw water is to be drained during this period of time and the clay liner protected. At the completion of mining of the North Pit works the reservoir is to be reinstated and re-filled. Water storage reservoir 6 (Figure 6-23) will then be taken offline for a period of 3.5 years (during the mining of South Pit) and reinstated at the completion of mining and backfilling activities.

During normal operation these water storages are gravity supplied from Fyans Creek, upstream of Lake Bellfield. During the summer months water is pumped from Lake Fyans as water levels are too low to fill the reservoirs via gravity. The reduced gravity storage capacity during the Project may require additional water to be pumped from Lake Fyans. However, appropriate mitigation has been developed in consultation with GWMWater to ensure the town water supply quality is not compromised during this period.

GWMWater potable water system

The potable water assets (Figure 6-23) that will need to be managed during the mining activities include:

- water storage tank 1 - low head supply tank
- water storage tanks 2 and 3 - high head supply tanks, which include the Bryne Street Pump that conveys potable water to the tanks from the raw water treatment plant.

During the mining of North Pit, water storage tank 1 will be taken offline and replaced by a temporary water supply system. Water storage tank 1 is to be protected while offline.

Water storage tank 2 is to be drained and retained in-situ for the duration of the Project. Water storage tank 3 will be decommissioned and dismantled and will not need to be reinstated at the completion of the Project.

Temporary water supply system

The temporary water supply system to be installed for the period that the tanks are off-line will have capacity to store the Stawell township daily water supply usage, which is less than 10 megalitres. The system will need to be able to supply water to both the low and high parts of town.

The temporary system includes the design of two five megalitre tanks located to the east of water storage tank 1 and will be 10 metres lower than the existing tank.

The Byrne Street pumps will replace water storage tanks 2 and 3 in order to supply the elevated sections of the Stawell township.
6 Project Description

SGM raw and potable water supply

The existing pipelines that supply potable and raw water to SGM will require relocation as a result of the Project. This will be undertaken at the same time as the installation of the two temporary five megalitre water supply tanks. The final design of the SGM raw water supply system will be conducted should the Project be approved.

It is proposed to re-activate the disused potable supply from Leviathan Road to replace SGM’s current water supply system (Figure 6-23).

A concept management plan is to be prepared that includes the confirmed supply rates from SGM and the discussions with GWMWater. These are to be used to assist in preparation of the concept layout plan, with hydraulic sizing, long sections on all pipelines and use advice from GWMWater for the selection of proposed meter locations.

6.6 Site Security

The Project’s operational area will be fenced in a manner similar to the existing security fencing around the current SGM operations. The fencing will extend from the existing security fence surrounding GWMWater water storage reservoirs 4, 6 and 7 and will extend to cover the TWRS and associated stock piles and surface water drainage facilities (Figure 6-24).
6 Project Description

Figure 6-24 Existing SGM fenceline and additional fenceline required for the Project
6 Project Description

The western boundary will be extended from the current line to include the full operational area of both pits. This fence will be situated at a suitable distance from the pit crest to ensure public safety at all stages of the operation.

High output LED portable lighting plants will be utilised to light the North and South Pits and haul road intersections to ensure the safety of mine staff during certain times of the year at the beginning and/or end of the shift. The lighting will be angled away from residential premises.

6.7 Mobilisation of Mining Equipment

Mobilisation and demobilisation of up to 29 pieces of mobile plant (including excavators, haul trucks and bulldozers) to the Project area will be required at the beginning and conclusion of the Project. However, arrivals are assumed to be staggered over a number of weeks.

Table 6-2 details each type of equipment that will be required throughout the Project.
### Table 6-2  Maximum mining equipment required from Q1-20 of mining and rehabilitation

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</tbody>
</table>

Legend (no. vehicles required):

|       | 0-2 | 3-5 | 6-8 |
6 Project Description

6.8 Mining Method

6.8.1 Overview
The Project encompasses the development of two open cut pits to mine the upper portion of the same mineral deposit as the current underground operations. Both the North and South Pit areas were also previously mined in late 1890s, and the southern area again in the 1980s (Davis Pit).

The mining of Big Hill will remove voids created by previous mining activities, which will improve public safety of the rehabilitated landform and allow future development of the site.

The ore body will be mined in an open pit top down sequence. Mining of the North and South Pits will be completed from east to west, with multiple benches shielding adjacent residents from noise and dust emissions. Two distinct mining methods will also be applied: the first one of free dig and the second drill and blast. 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.

The Project does not include any extension to the current underground mining operations. Currently underground mining operations are accessing the Mariners orebody, which is the down dip extension of the North Pit resource. Any underground operations will be conducted under the current permitted mining licence. The processing plant, tailings facility, workshops, and amenities buildings are currently operational and available to support the Project. Their locations are shown in Figure 6-1.

The ore mined will be processed through the existing SGM processing plant and tailings from the processing plant pumped to the approved tailings storage facility, TSF 2, located approximately three kilometres from the plant (refer to Chapter 4, Section 4.8.1 for details about TSF 2).

6.8.2 Open Pit Design
The two pits have been designed to comply with the overall factors of safety as specified in Chapter 8, Section 8.9, while at the same time incorporating factors to minimise waste tonnes and maximise mineralised material. The pits have been designed using the following specifications:

- 15 metre wide single lane ramps with a gradient of 1:9
- a batter height of 20 metres with a batter angle of 60 degrees
- a berm width of five to 8.5 metres.

These design parameters assume 90 tonne haul trucks and a 100 tonne to 190 tonne excavator for use as the primary mining fleet.

Initially, the weathered material will be removed using excavator and trucks. As the rock becomes harder, drilling and firing of the material may be required, and the broken material removed by excavator and truck.

From full analysis of the diamond drilling results and sonic velocity testing of the subsequent holes, it is estimated that only the bottom two benches will be required to be drilled and fired. Harder material encountered above this will be ripped via bulldozer where required.
6 Project Description

The upper section will be mined using conventional open cut techniques with hydraulic excavators, and the use of track dozers for pre-ripping where required. Drill and blast techniques will only be applied once all other efficient extraction methodology has been exhausted.

6.8.3 Ore Handling

Mining will be in an open pit top down sequence, and divided into two stages. As outlined above, mining will involve use of excavators and trucks with some drilling and firing of materials at depth.

The quantities of ore and overburden to be removed and the materials handling schedule anticipated are outlined in Table 6-4.

Table 6-3 Quantities of ore and overburden extracted

<table>
<thead>
<tr>
<th>Stage</th>
<th>Ore (m$^3$)</th>
<th>Ore (tonnes)</th>
<th>Overburden (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Pit</td>
<td>661,520</td>
<td>1,389,193</td>
<td>919,780</td>
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<td>South Pit</td>
<td>730,903</td>
<td>1,534,897</td>
<td>3,024,324</td>
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<td>Total</td>
<td>1,392,423</td>
<td>2,924,090</td>
<td>3,994,104</td>
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</tbody>
</table>

Table 6-4 Proposed mining schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Oxide ore (t)</th>
<th>Transition ore (t)</th>
<th>Sulphide ore (t)</th>
<th>Total ore (t)</th>
<th>Waste rock (t)</th>
<th>Waste rock to TWRS (t)</th>
<th>Waste rock to backfill (t)</th>
</tr>
</thead>
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<td>4,250,608</td>
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<tr>
<td>Total</td>
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<td>-</td>
<td>2,924,090</td>
<td>8,282,431</td>
<td>5,399,809</td>
<td>9,258,534</td>
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</tbody>
</table>

6.8.4 Ore Processing

Existing processing plant will be used to process ore recovered by the Project. Due to the approvals for the processing plant already being in place, the plant has been excluded from the assessment process as part of this EES. SGM has operated the current process plant for more than 32 years. It is a conventional gravity/leaching process, which recovers gold from both underground fresh and surface oxidised ore sources. For oxidised ore sources (including that proposed to be mined from Big Hill) the process involves:

- two-stage crushing of the ore
- milling in a Ball Mill
- cyanide leaching of the ore in a Carbon in Leach (CIL) circuit.
6 Project Description

The CIL circuit allows concurrent leaching of the gold and adsorption of the gold onto activated carbon which can then be recovered for stripping. Once the gold is stripped from the carbon, the resulting gold sponge is smelted on site to produce gold bars (roughly 80 per cent pure), which is sold to the Perth Mint.

SGM has current Worksafe approval to store and handle all the dangerous goods necessary for the Project and also has a current permit to obtain cyanide (permit number 27207465) from the Victorian Department of Health. In addition, SGM will also use small quantities of hydrochloric acid, lime, caustic soda and lead nitrate, which is consistent with current operations.

6.8.5 Tailings Disposal

Tailings from the processing plant will be transferred to the existing tailings storage facility (TSF), located approximately three kilometres southwest of the plant. Details of this existing facility are provided in Chapter 4, Section 4.9.1.

Tailings pipeline lines from the processing plant to the TSF are bunded to prevent leakage into the surrounding environment. Pipes also have differential flow monitoring to provide early detection of any leakage. Both the TSF and pipelines are visually inspected on a three to four hour basis, as outlined in the approved EMP.

Monitoring and auditing of the safety and environmental features of the TSF are covered in three standalone documents:

- Operations and Monitoring Manual
- EMP (including Groundwater Management Plan)
- Emergency Response Plan.

In addition, during construction of any new embankment lift, there are detailed requirements for the monitoring and auditing of the safety and the environmental features, all of which are required to be documented and reported to DSDBI. TSF is also audited in the Annual Safety and Performance Review by a suitably qualified engineer and reported to Earth Resources Regulation (DSDBI).

6.8.6 Backfilling Pit Voids

Backfilling and rehabilitation of each pit is scheduled to commence immediately following the completion of mining.

It is proposed that the necessary compaction needed for the backfilling of North Pit will be greater than South Pit given its requirement for the re-installment of a number of structures (e.g. rotunda, monuments, road access). As a result, North Pit has been divided into four different zones, each with a different type of material mix and compaction criteria, anticipating the future use of the land upon completion of the mining works. This fill placement and compaction design aims to allow early re-establishment of the memorial and access tracks. The memorial Rotunda and Big Hill Road will be re-established in their current locations above approximately 25-30 metres of backfilled material. Details of the backfill strategy are provided in Chapter 10.

North Pit backfill material will consist of a combination of fresh and oxide waste material in a 2:1 ratio. The backfill will be placed in two 20 metre lifts. Each lift will be formed with a single tip head, where the haul trucks operating in the area will compact the waste material.
6 Project Description

A number of other material placement methods will be adopted for the project to ensure adequate compaction is achieved in both pits:

- Tip Head Dumping, which involves the establishment of a tip head where the mining trucks will either tip over the edge of the waste area or tip short and the material will be pushed over. The method allows for rapid fill placement with compaction applied from the equipment on the tipping surface.

- Paddock Dumping, which achieves high levels of compaction through the weight of the loaded mining trucks.

- Surface Contouring is where material is brought in and placed in layers of not more than 600 millimetres and then rolled using a vibrating or sheep foot roller to compact each layer. This will be used on the final contour to ensure the long term stability of the landform surface.

6.8.7 Rehabilitation

Rehabilitation of the Project area will aim to leave a final landform that is visually compatible with the adjacent Big Hill landscape; is stable; will not erode; and provides an adequate substrate for vegetation establishment and growth. Key elements of the rehabilitation of the Project area include ensuring that:

- appropriate surface hydrology and soil surface stability are re-established

- appropriate vegetation species are selected to ensure re-establishment

- properties of the reconstructed soils are appropriate for the long-term growth and survival of selected plant species.

To manage and mitigate the potential risks associated with these key elements, the focus of the landform design for the reconstruction of the Big Hill topography will be to minimise slope length and angle, within the constraints imposed by needing to backfill the open pits to achieve the original elevation. As part of this approach, soil and waste materials most likely to resist erosion, while providing acceptable growth medium for vegetation, will be selected for the outer surfaces. Additionally, the backfilled slopes will include level containment benches with a spacing of 40-50 metres, and inter-bench slopes no steeper than 3H:1V.

During mining operations, waste materials will be regularly sampled and evaluated in terms of their physical and chemical characteristics. Waste material will be screened for the following properties in order to identify material suitable for placement on the outer surface of backfilled landforms prior to topsoil placement:

- total sulphur

- total metal concentrations

- erosion resistance

- soil water retention properties

- capacity to support vegetation growth.
6 Project Description

Topsoil will be salvaged where possible from areas to be disturbed in the Project areas, and will be stockpiled and later respread on areas to be rehabilitated. The topsoil to be spread will be selected from the topsoil resources available on the whole SGM site, with the aim of maximising beneficial soil properties and minimising the potential for stored weed seeds and erodibility.

The selected species used to revegetate will be established using broadcast seed and tubestock. If considered beneficial and practical, in terms of enhanced establishment and survival of vegetation, a reticulated irrigation system will be installed on high priority rehabilitation areas.

A framework of objectives and criteria for rehabilitation and closure of the Project area will be developed in consultation with stakeholders. This will form the basis for ensuring planned rehabilitation and closure outcomes are achieved. The closure criteria will also be a focus for developing an appropriate monitoring program. Monitoring will continue beyond the life of the Project, focusing on ecosystem development and function, to demonstrate that objectives for rehabilitation and closure have been met.

6.8.8 Waste Rock Management

As outlined earlier, a temporary waste rock stockpile (TWRS) will be constructed on the natural ground surface, to the east of the proposed pits on GWMWater land. It will accept all waste rock from the Project, with no material needed to be transported elsewhere across the site. All material from the TWRS will be used to backfill the pit voids and rehabilitation of the Project includes ultimate reinstatement of the TWRS land back to a grazing paddock.

The TWRS will be in existence for the duration of the Project, but at its maximum height (approximately 50 metres) for less than 2 years. The factors of safety for the TWRS range from 1.7 to 2.4 (Chapter 8, Section 8.9), assuming different strength parameters and water conditions. These factors of safety are considered appropriate for the relatively short term storage of waste rock.

The toe of the TWRS will be approximately 15 metres from an existing water storage reservoir, operated by GWMWater. A bund will be maintained at the toe of the stockpile for protection against rolling or washout of waste rock.

6.8.9 Water Management

Pit dewatering

The hydrogeology of the Project area is dominated by a regional water table aquifer system that has been lowered significantly from the last 18 years of underground dewatering. Groundwater in the immediate area occurs within fractured rocks of low to moderate permeability, and is well below the base of the pits. It is assumed therefore that no groundwater will be intercepted during mining and no management of groundwater inflows are required. This is further detailed in Chapter 8, Section 8.12.

Water use

It is estimated that 60 megalitres of water per year will be needed for the Project, primarily for dust suppression. This volume is in addition to the water requirements required for processing ore, but is slightly less than what was used in the past for underground operations.
6 Project Description

Water for the Project and ongoing operation of the mine will be sourced from harvested rainfall runoff, recycling of process water from the tailings facility, and by way of a 1 megalitre per day licence from GWMWater.

Chapter 4 provides details on the existing on-site water storages and their sources for use during the Project. The capacity of the site water storages is currently approximately 690 megalitres, and this will not be modified for the duration of the Project.

**Surface water management - during operations**

The operational surface water management for the Project comprises no off-site discharge (full containment) and sediment and erosion control for disturbed areas associated with mining operations. Details are provided in Chapter 8, Section 8.11.

In summary, the management plan for surface water from the Project areas is as follows:

- direct all rainfall runoff from disturbed areas so that all contaminated runoff is contained, managed, treated and reused within the site as appropriate
- adopt a 100 year ARI\(^1\) level of service for surface water channels
- ensure runoff from the rehabilitated site is of suitable quality prior to allowing connection to the existing drainage network
- design treatment measures based on the relevant Guidelines.

During operations, runoff from disturbed areas will be captured on site and utilised for dust suppression and general site works. Water not used immediately will be pumped to SGM existing storages.

Water that falls within the North and South Pit during operations will be collected in mobile sumps and utilised for dust suppression, although it is anticipated that most incident rainfall that falls within the pit will infiltrate the rock material and/or enter the underground voids.

As the Project area is reinstated, standard construction erosion and sediment control techniques will be employed to ensure that dirty water runoff is contained on site. Vegetated cut-off drains and sediment basins will convey and capture surface runoff which will also be pumped to existing mine storages.

**Surface water management – post mining**

The water quality features that will be utilised in the closure stage will be swales and sediment basins and will be designed to capture sediment to best practice standards. These features will be constructed during the operations phases to allow vegetation to establish prior to coming online.

All erosion and sediment controls will remain in place post mining until vegetation has established. Once the disturbed land is stable and vegetated and water quality improves to the point it is of similar quality to that of the runoff from the natural environments, the existing surface water flow regime(s) will be re-instated.

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\(^1\) The average recurrence interval (ARI) is a term used to describe the magnitude of a flood and the likelihood of that flood occurring in any given year
6 Project Description

Erosion and sediment control techniques will be adopted for all disturbed areas and during rehabilitation in accordance with the EPA publication *Environmental Guidelines for Major Construction Sites*.

### 6.9 Transport, Handling and Storage of Consumables

The scope and size of the Project means that there will be no change in the type of chemicals and consumables needed from current SGM operations. Further, given that the rate of ore production will be less than current, the transport, handling and storage of all consumables (including chemicals) for the processing of ore will be within existing capacities.

The fuel usage is also anticipated to decrease from current volumes. Table 6-5 outlines recent fuel consumption at the site, and also provides an estimate of Project fuel usage over the 5 years based on materially handling volumes.

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<th>Year</th>
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<td>July 2010 - June 2011</td>
<td>4,459,569</td>
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<tr>
<td>July 2011 - June 2012</td>
<td>4,337,298</td>
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<tr>
<td>Year 1 (Projected)</td>
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<td>Year 2 (Projected)</td>
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<td>Year 3 (Projected)</td>
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<td>Year 5 (Projected)</td>
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</tr>
</tbody>
</table>

Fuel storage and handling for the surface mine fleet will be in accordance with existing procedures, and as outlined above SGM existing facilities will have more than sufficient capacity.

### 6.10 Operational Details

#### 6.10.1 Hours of Operation

Open pit 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 maintenance and environmental management activities including maintenance of stationary equipment, roads, TWRS, pit batters and void management activities.

By comparison, the current operation, which includes underground mining and the processing of ore, operates 24 hours a day, seven days a week, consistent with existing mine licence conditions.

The majority of shift personnel will operate on a shift roster in which they will work four shifts of 12 hours each followed by four days off. Administrative, design and management functions will also operate on a day shift basis, with management support provided seven days a week.
6 Project Description

6.10.2 Workforce

The intent of the Project is to retain the existing SGM workforce where possible, while acknowledging specialist services will be required for some tasks.

A summary of the total personnel required throughout the Project is provided in Table 6-6.

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
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6.11 Health, Safety and Environmental Policies

SGM has an existing *Workplace Health and Safety Policy* and *Environment Policy*. This document establishes SGM’s values and ongoing commitments in relation to health, safety and the environment.

The SGM goal for excellence in environmental management and performance is underpinned by the management systems, organisational structures and expertise in place to manage the business for sustainable growth.

To fulfil SGM’s commitment to the environment SGM aims to continually improve its environmental performance by regularly:

- reviewing objects and targets
- monitoring performance against objectives and targets
- evaluating our environmental risks and striving to implement appropriate controls.

The SGM Environment Review Committee (ERC) meets quarterly in order to review the company’s environmental performance. These meetings are attended by representatives from the community, EPA and the Earth Resources Regulation (DSDBI).

SGM also has a rigorous commitment to health and safety with incentives provided to staff for achieving zero lost time due to injury.

All of the systems and processes in place as part of current operations will be applied to the Project.

6.12 Conclusion

The Project outlined above has resulted from significant levels of investigation of the ore body underpinning the development and iterative review of the most efficient means of mining to achieve a viable commercial operation with acceptable social and environmental outcomes. The sequencing of mining facilitates progressive rehabilitation of the site and much of the operation is self-contained using existing infrastructure such as the processing plant and the TSF.