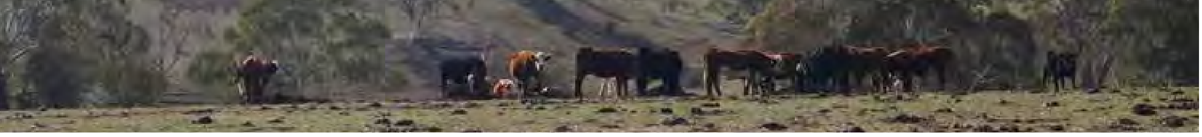

McPhillamys Gold Project
Environmental Impact Statement

Prepared for LFB Resources NL
August 2019

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Directory

Declaration

For submission of an environmental impact statement (EIS) under Part 4 of the NSW Environmental Planning and Assessment Act 1979.

EIS prepared by

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Description of development

McPhillamys Gold Project
Refer to Chapter 2 of this EIS for a description of the proposed development

Land to be developed

Refer to Appendix A of EIS

Declaration

We confirm that we have prepared this EIS in accordance with the Environmental Assessment Requirements issued for the McPhillamys Gold Project and that the:

- EIS has been prepared in accordance with Schedule 2 of the EP&A Regulation 2000;
- EIS contains all available information that is relevant to the environmental assessment of the proposed development; and
- Information in the EIS is neither false or misleading.

N.

Janet Krick
Senior Environmental Planner
27 August 2019

Nicole Armit
Associate Director
27 August 2019

McPhillamys Gold Project

Environmental Impact Statement

Prepared for LFB Resources NL
August 2019

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McPhillamys Gold Project

Environmental Impact Statement

Report Number

RP#1

Client

LFB Resources NL

Date

27 August 2019

Version

Final

Prepared by

Janet Krick
Senior Environmental Planner
27 August 2019

Approved by

Nicole Armit
Associate Director
27 August 2019

Executive Summary

ES1 Introduction

LFB Resources NL is seeking development consent for the construction and operation of the McPhillamys Gold Project (the project), a greenfield open cut gold mine and associated water supply pipeline in the Central West of New South Wales (NSW), as shown in Figure ES1. The project comprises two key components:

- the mine site where the ore will be extracted and processed (herein referred to as the mine development), and;
- and an associated water pipeline which will enable the supply of water from near Lithgow to the mine site (herein referred to the pipeline development).

Up to 8.5 Million tonnes per annum (Mtpa) of ore will be extracted from the McPhillamys gold deposit over a total project life of 15 years. Water will be supplied to the mine site via an approximate 90 kilometre (km) long pipeline, transferring surplus water from Centennial Coal's Angus Place Colliery (Angus Place) and Springvale Coal Services Operations (SCSO), and Energy Australia's Mount Piper Power Station (MPPS) near Lithgow, to the mine.

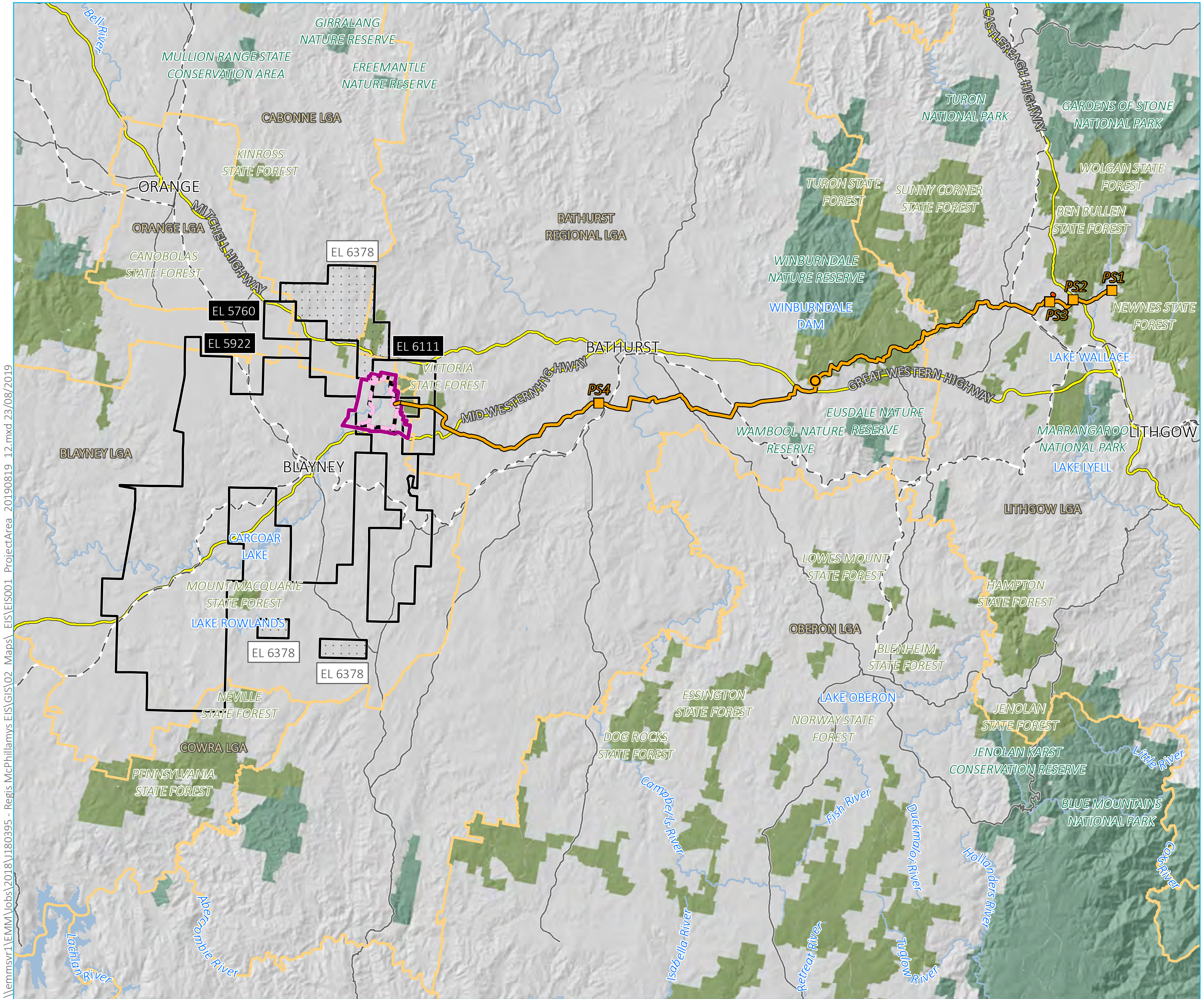
LFB Resources NL is a 100% owned subsidiary of Regis Resources Limited (herein referred to as Regis). Regis is an Australian gold miner with a proven record of developing gold mining operations and is one of the top five Australian gold companies by market capitalisation and production. Regis acquired Exploration Licence (EL) 5760 in November 2012 and has since conducted detailed geological, environmental, financial and other technical investigations to define the McPhillamys resource and to identify and address environmental and other constraints. The large investment proposed to construct and operate the project will provide substantial economic stimulus and benefits to the Australian, NSW and local economies.

ES2 Project application area

The area in its entirety to which the McPhillamys Gold Project development application (SSD 9505) relates is defined in this Environmental Impact Statement (EIS) as the project application area; comprising the mine development project area and the pipeline corridor as illustrated in Figure ES1. The project application area totals approximately 2,640 hectares (ha) (comprising the mine project area of 2,513 ha and pipeline corridor of 127 ha). The disturbance footprint within the mine project area is approximately 1,135 ha to accommodate the mine development, which includes the open cut mine, tailings storage facility (TSF), waste rock emplacement, Run-of-Mine (ROM) pad, processing plant, administration area and workshop, water management facilities, topsoil stockpiles, roads and other ancillary areas. The indicative layout of the mine development is illustrated in Figure ES3.

The mine development project area is in the Central Tablelands region of NSW, approximately 8 km north-east of Blayney, 20 km west of Bathurst and 27 km south-east of Orange (refer to figure ES2). The mine development is mostly within the Blayney local government area (LGA), with a small portion extending into the Cabonne LGA. The mine project area is zoned RU1 Primary Production under both the *Blayney Local Environmental Plan 2012* and *Cabonne Local Environmental Plan 2012*. The mine development is in the upper reaches of the Belubula River catchment, within the greater Lachlan River catchment.

The mine project area is surrounded by a variety of land uses, predominately agriculture, as well as scattered rural residences, forestry and natural areas. It is bounded by the Vittoria State Forest to the north-east and east, and the Mid-Western Highway to the south. The land adjacent to the north and west comprise mainly agricultural areas and rural residences. The Kings Plains settlement is directly south of the mine project area on the southern side of the Mid Western Highway, with a small population of approximately 45 people (Hansen Bailey 2019).



KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment
- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest
- Local government area

Exploration lease boundaries (of interest)
- Held by LFB Resources NL (Regis)
- Held by others

Source: EMM (2019); Regis Resources (2019); DPE (2018); DFSI (2017); GA (2011)

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Regional setting - project application area

McPhillamys Gold Project
Environmental impact statement
Figure ES1

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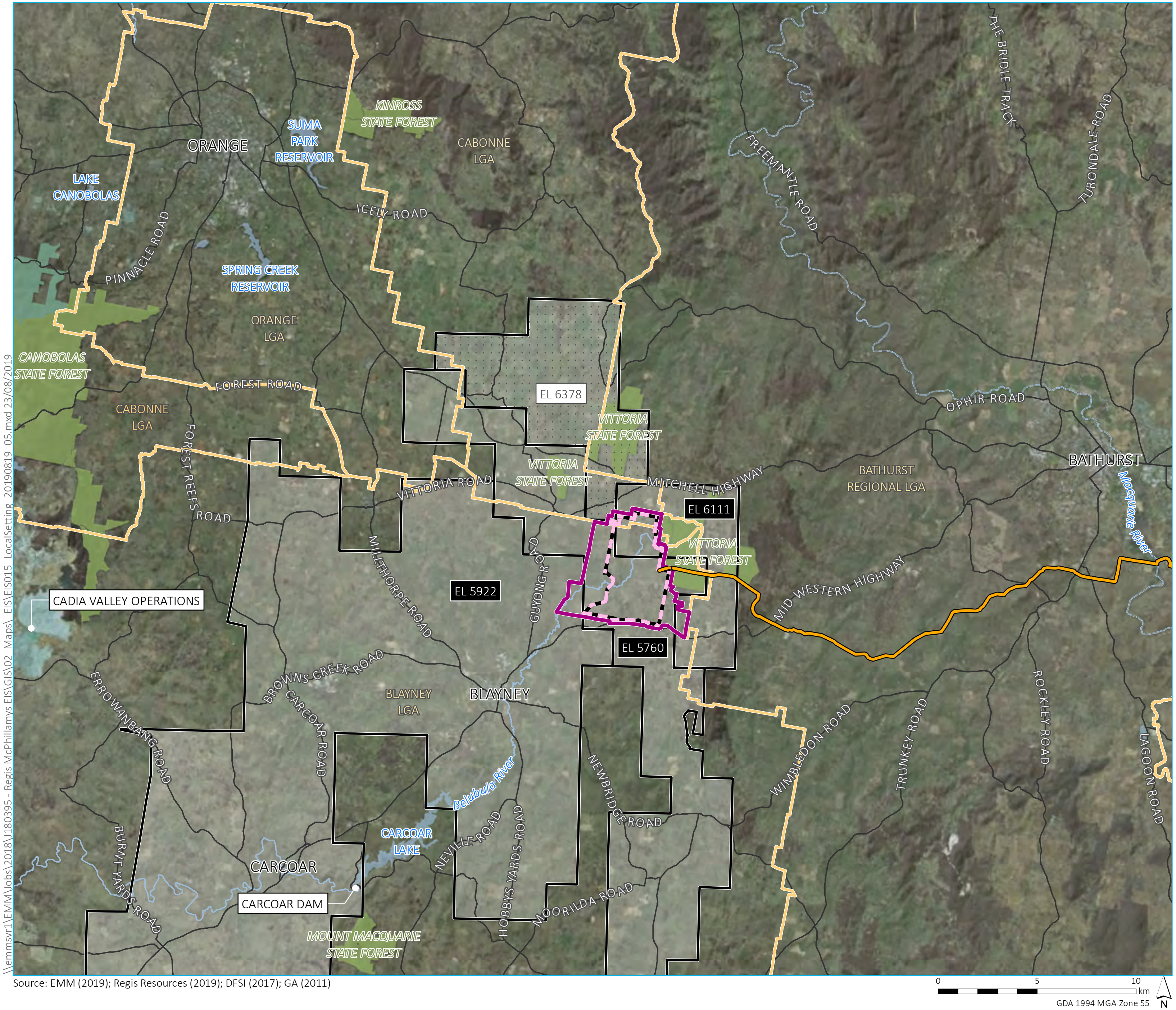

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor

Existing environment

- Main road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Local government area

Exploration lease boundaries (of interest)

- Held by LFB Resources NL (Regis)
- Held by others

Local setting of the mine development

McPhillamys Gold Project
Environmental impact statement
Figure ES2

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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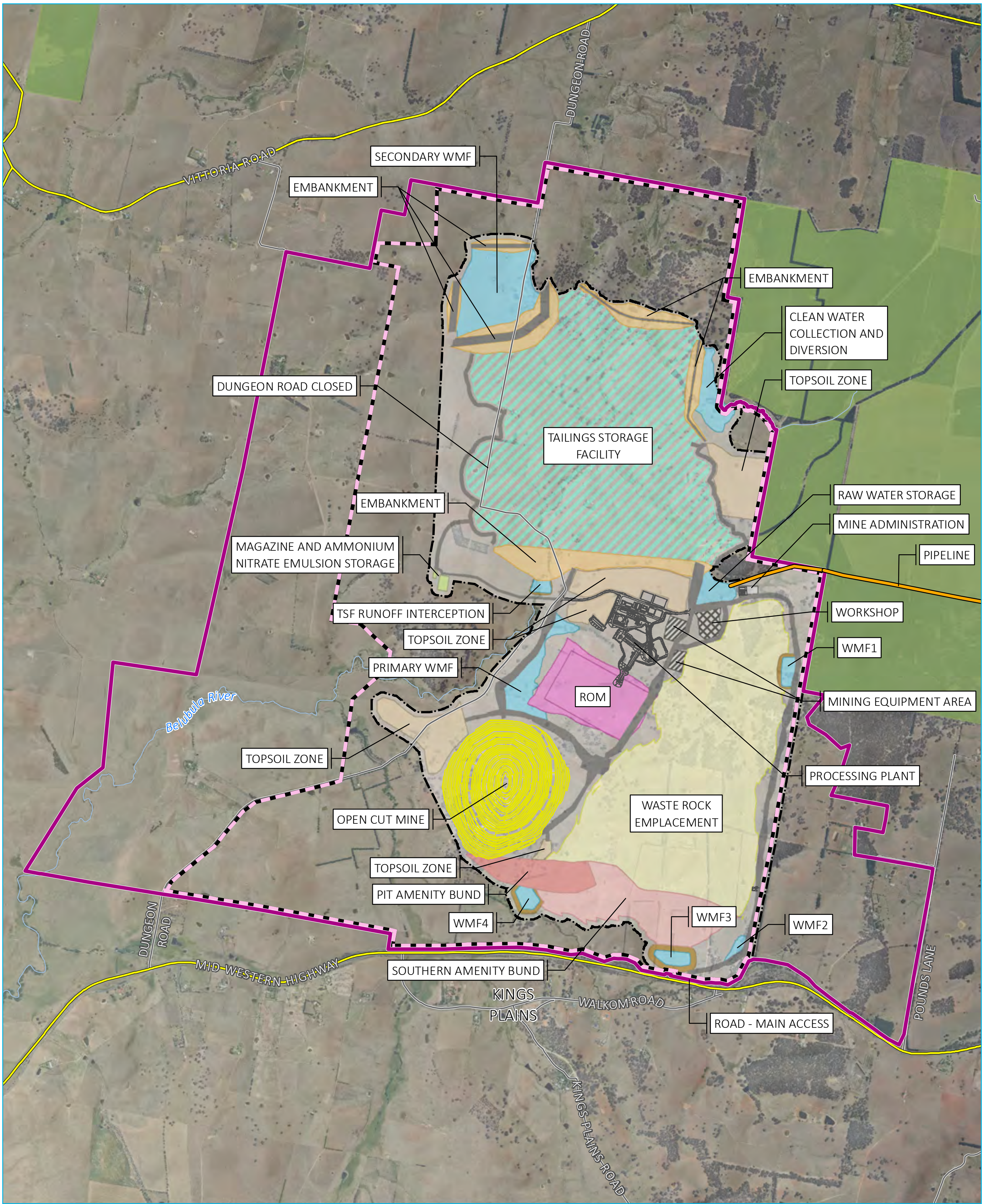

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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Project general arrangement

- Plant layout
- Road
- Water management facility (WMF)
- Sediment basin structure

Existing environment

- Main road
- Local road
- Belubula River
- Vittoria State Forest

Mine development general arrangement

McPhillamys Gold Project
Environmental impact statement
Figure ES3

The pipeline corridor traverses the LGAs of Lithgow, Bathurst and Blayney, extending for approximately 90 km from Angus Place, SCSO and MPPS at its eastern extent in the Blue Mountains to the mine development at its western extent. The pipeline corridor alignment primarily traverses land used for agriculture, consisting of mostly cleared, open paddocks used for sheep and cattle grazing. The alignment of the pipeline has been carefully planned to utilise disturbed ground, such as existing road easements and tracks, as much as possible. The pipeline corridor also travels through the Vittoria State Forest, Sunny Corner State Forest, Ben Bullen State Forest, and a number of road reserves.

The corridor will accommodate all components of the pipeline development including pumping station facilities and associated pipeline infrastructure. The pipeline corridor ranges in width along its length from 6 m to 20 m, excluding the four pumping stations facilities. At these facilities, the corridor width extends to an area of up to 75 m by 75 m to accommodate the construction and operation of these facilities. The width of the corridor has been carefully defined in consideration of property, infrastructure and environmental constraints.

ES3 Project overview

Regis is seeking SSD consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to develop and operate the project.

Regis also referred a proposed action to the Commonwealth Minister for the Environment (Commonwealth Minister) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This referral (EPBC Act referral 2019/8421) only related to the mine development: the referral did not include the pipeline development. On 28 May 2019, a delegate of the Commonwealth Minister determined under section 75 of the EPBC Act that the proposed action is a controlled action. As such, the proposed action will also need to be assessed and approved under the EPBC Act.

The key aspects of the project are summarised below.

- Development and operation of an open cut gold mine, comprising approximately one to two years of construction, approximately 10 years of mining and processing and a closure period (including the final rehabilitation phase) of approximately three to four years, noting there may be some overlap of these phases. The total project life for which approval is sought is 15 years.

- Development and operation of a single circular open cut mine with a maximum diameter at the surface of approximately 1,050 metres (m) and a final depth of approximately 460 m, developed by conventional open cut mining methods encompassing drill, blast, load and haul operations. Up to 8.5 Million tonnes per annum (Mtpa) of ore will be extracted during the project life.

- Construction and use of a conventional carbon-in-leach processing plant with an approximate processing rate of 7 Mtpa to produce approximately 200,000 ounces, and up to 250,000 ounces, per annum of product gold. The processing facility will comprise a run-of-mine (ROM) pad and crushing, grinding, gravity, leaching, gold recovery, tailings thickening, cyanide destruction and tailings management circuits. Product gold will be taken off-site to customers via road transport.

- Placement of waste rock into a waste rock emplacement which will include encapsulation of material with the potential to produce a low pH leachate. A portion of the waste rock emplacement will be constructed and rehabilitated early in the project life to act as an amenity bund.

- Construction and use of an engineered tailings storage facility to store tailings material.

- Construction and operation of associated mine infrastructure including:

  - administration buildings;
  - workshop and stores facilities, including associated plant parking, laydown and hardstand areas, vehicle washdown facilities, and fuel and lubricant storage;
  - internal road network;
  - explosives magazine and ammonium nitrate emulsion (ANE) storage;
  - topsoil, subsoil and capping stockpiles;
  - ancillary facilities, including fences, access roads, car parking areas and communications infrastructure; and
  - on-site laboratory.
- Establishment and use of a site access road and intersection with the Mid Western Highway.
- Construction and operation of water management infrastructure, including raw water storage dam, clean water and process water diversions and storages, and sediment control infrastructure.
- A peak construction workforce of approximately 710 full-time equivalent (FTE) workers. During operations, an average workforce of around 260 FTE employees will be required, peaking at approximately 320 FTEs in around years four and five of the project.
- Construction and operation of a water supply pipeline approximately 90 km long from Centennial's Angus Place and SCSO; and Energy Australia's MPPS operations near Lithgow to the mine development project area. The pipeline development will include approximately four pumping station facilities, a pressure reducing system and communication system. Approximately 13 ML/day (up to a maximum of 15.6 ML/day) will be transferred for mining and processing operations.
- Installation and use of environmental management and monitoring equipment.
- Progressive rehabilitation throughout the mine life. At the end of mining, mine infrastructure will be decommissioned, and disturbed areas will be rehabilitated to integrate with natural landforms as far as practicable. The final landform, apart from the final void, will support land uses similar to current land uses or land uses consistent with land use strategies of the Blayney and Cabonne LGAs.

ES4 Impact assessment

Thorough technical assessments have been undertaken of all potential environmental and social impacts associated with the project. As explained in Chapter 6 of this EIS, project planning included multiple rounds of design, assessment and refinement based on the results of these technical assessments to avoid impacts or, if unavoidable, minimise and/or offset them.

The findings of the detailed technical assessments are provided in the body of this EIS and the appendices. The following sub-sections provide an overview of the main findings; however, to gain a proper understanding of the project, the detailed assessments should be read in their entirety.

ES4.1 Mine development

ES4.1.1 Soil and land resources

A land capability and soil assessment was undertaken, including a baseline assessment across the mine project area, involving a biophysical strategic agricultural land (BSAL) verification assessment, a detailed soil survey and a land and soil capability assessment. The assessments involved a desktop review of existing land and soil data, a field assessment and laboratory analysis of collected soil samples.

The BSAL assessment was undertaken in accordance with the requirements of the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSWG 2013) (the interim protocol). The BSAL assessment verified the mining lease application area as 'non-BSAL' and a Site Verification Certificate (SVC) was subsequently issued for the mine development by the Department of Planning and Environment (DPE – now the Department of Planning, Industry and Environment (DPIE)) on 18 June 2019.

Up to 1,135 ha of land will be disturbed to develop and operate the mine. This will result in some changes to the land and soil capability (LSC) class across the mine project area compared to the existing landscape; primarily a reduction in LSC class 5 land and an increase in land with an LSC class of 6. The mine project area currently comprises mostly LSC class 4 (moderate capability) and LSC class 5 land (moderate-low capability land). This is reflective of the existing land use in the project area, which is mainly agriculture, consisting of mostly cleared open paddocks utilised for cattle grazing.

Upon completion of mining all surface infrastructure will be removed and the area rehabilitated to a condition that is stable and supports the post mining land use, which will typically be grazing. Post mining, the rehabilitation landform will predominantly be a combination of class 4, class 5 and class 6 land. Notably, the LSC class across parts of the TSF footprint will be improved from a pre-mining LSC class 5 to a post-rehabilitation LSC class 4. This commitment to rehabilitating the TSF final landform to achieve an LSC class of 4 means that there will be only a minimal change in class 4 land across the disturbance area as a result of the mine development.

The change in LSC classes in the mine project area post-mining will be as follows: a reduction in LSC class 4 by 12 ha, a reduction in LSC class 5 by 411 ha, an increase in LSC class 6 by 336 ha, an increase in LSC class 7 by 17 ha and an increase in LSC class 8 by 70 ha (associated with the open cut void). Therefore, the majority of the site will be suitable for the continuation of agricultural land use post mining.

Soil erosion minimisation practices will be adopted during earthworks required for the mine development, in accordance with the Landcom (2004) publication *Managing Urban Stormwater: Soils and Construction – Volume 1* and DECC (2008) *Volume 2E – Mines and Quarries* (the Blue Book). In addition, drainage structures such as sediment dams will be constructed and maintained as part of the water management system as required throughout the project life, also in accordance with the Blue Book.

ES4.1.2 Agricultural resources

An agricultural impact statement was prepared for the mine development, which assessed the potential impacts of the mine on agricultural resources within and surrounding the mine project area. The assessment involved detailed database searches and mapping review, such as ABS Agricultural Census Data, review of public information, consultation with relevant technical specialists and the review of other relevant assessments supporting the EIS.

All identified potential risks to agricultural resources were assessed as being low, provided the specified mitigation measures are implemented. Importantly, as described above there is no BSAL located in the mining lease application area and proposed disturbance area associated with the mine development.

The financial impact to the agricultural industry income of the proposed disturbed land in the mine project area was calculated to be a reduction of $406,193 /year during the mine life and $95,373 / year upon rehabilitation, which equates to approximately 1% and 0.2% respectively, of the total $42.7 million of income from agriculture within the Blayney LGA.

ES4.1.3 Water resources

Water-related technical studies included development of a water balance and numerical groundwater model for the mine development, and assessments of surface water quality, surface water flow and geomorphology, flooding, groundwater and hydrochemistry.

The mine development water management system has been designed to avoid discharge of process affected water offsite. The system includes a series of clean water diversions to minimise the volume of clean water flowing into the mine disturbance footprint, and a series of water management facilities to effectively contain and manage sediment laden/process water. Numerical modelling and analytical techniques have been used to develop the site water balance and predict water quantity and quality changes to surface water and groundwater resources. The impacts on surface water and groundwater as a result of the mine development are predicted to be minimal and impacts to downstream water users are predicted to be minor, as described further below.

i Groundwater

The mine development is within the Lachlan Fold Belt Murray Daring Basin (MDB) Groundwater Source. Groundwater in this source is managed by the Water Sharing Plan for the *NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2011*. The groundwater source is generally not highly productive and groundwater abstraction within the Silurian and Ordovician formations is generally for stock and domestic purposes.

The mine development will result in a decline in groundwater levels in a localised area surrounding the open cut mine. The NSW *Aquifer Interference Policy* (AIP) requires 'make good' provisions to be made for landholder bores affected by a greater than 2 m drawdown as a result of the project; however, no third party bores are predicted to experience a drawdown in excess of 2 m as a result of the project.

Based on the results of the groundwater model, the maximum take of groundwater as a result of open cut mining which will need to be accounted for by water access licences (WALs) is 890 ML/yr, which is predicted occur in around mining Year 2. The ongoing groundwater inflow to the pit void which will need to be accounted for by WALs post mining is predicted to be around 200 ML/yr.

The groundwater inflow will be from the Lachlan Fold Belt MDB Groundwater Source, with a very minor contribution over time from the overlying water source. Regis has secured approximately 45% of the required groundwater licence volume. Application for the remaining 490 ML of groundwater licence requirements from the Lachlan Fold Belt MDB Groundwater Source through controlled allocation and/or water trades is proposed to obtain the remaining groundwater licence volume, to secure the total required volume of 890 ML.

The design of the TSF includes multiple features to manage seepage including lining/conditioning of the TSF storage area to meet EPA’s permeability requirements and the construction of a seepage collection drain at the toe of the main embankment. Seepage is predicted to remain within the saprock zone, flowing in a horizontal direction. Some of the seepage that migrates south from the TSF is predicted to seep towards the pit. A percentage of the seepage is predicted to move towards the Belubula River at a rate of approximately 50 m in 100 years. Importantly, the results of the groundwater assessment indicate that even without all seepage management measures in place, any seepage that may migrate through the hydrostratigraphic units (units that act as aquifers or aquitards) towards the Belubula River will have concentrations below the observed baseline surface water quality concentrations, ANZECC (2000) livestock drinking water and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values (for analytes with elevated concentrations in the tailings liquid fraction results).

Mine development activities are not anticipated to result in a lowering of the beneficial use category of the groundwater source beyond 40 m from the mine development, provided the mitigation measures discussed in Chapter 9 are implemented.

ii Surface water

The mine development is in the upper reaches of the Belubula River catchment, within the greater Lachlan River catchment. The Belubula River has its headwaters immediately north-east of the mine project area and flows to the south-west into Carcoar Dam (approximately 26 km south-west of the mine development).

A temporary reduction in the inflow to Carcoar Dam (4%) will occur as a result of construction and operation of the mine. Permanently, after mine closure and rehabilitation, the reduction in flows will be much smaller (0.5% reduction). This level of change is expected to be within the current natural variability of catchment conditions.

Currently, flow in the Belubula River between the mine project area (ie downstream from the project area boundary) and above Carcoar Dam ranges from around 697 ML/yr to 1,436 ML/yr under low rainfall (95th percentile) conditions. When the mine is at its maximum disturbance footprint, it will decrease surface water flows by around 61 ML/yr, so that flow in the Belubula River between the mine project area and Carcoar Dam will range between at least 636 ML/yr and 1,402 ML/yr under these same low rainfall conditions. This represents between a 9% and 4% reduction, respectively. During these low rainfall periods when downstream users are most reliant on water within the Belubula River, groundwater discharge as baseflow in the Mid Western Highway area is predicted to remain unchanged from current conditions.

In relation to flooding, as the mine development is in the headwaters of the catchment, localised flooding impacts will be confined to land owned by Regis. Changes to flood levels and flood peak velocities are predicted to be minimal and construction of a flood levee is not warranted.

The TSF has been designed to avoid adverse impacts to the surrounding environment and is large enough to contain all water from sustained rainfall events with minimal spill risk. The mine development is not anticipated to result in a lowering of the beneficial use category of local surface water sources. Water quality effects will be able to be mitigated and/or managed appropriately.

In relation to the final void, once mining has ceased the open cut (or pit lake) will slowly fill with water, recovering to an elevation of around 902 m AHD. The pit lake is predicted to take around 400 years to reach this elevation. The results of the final void water balance model predict that the pit lake water level will remain below ground surface and will not spill.

ES4.1.4 Noise, vibration and blasting

The mine design and indicative schedule for which approval is sought has been developed through an iterative process, largely in consideration of the outcomes of noise modelling for both construction and operation of the mine. Given the close proximity of the mine project area to a number of residences, particularly in the Kings Plains locality, some key design changes were incorporated into the project where reasonable and feasible to do so, so that noise emissions can be managed effectively at these nearest residences (referred to as sensitive receptors in this EIS), and minimised as much as possible.

Noise levels during the initial site establishment period (ie the first 6 months or so) are predicted to exceed the relevant noise management level (NML) (as defined in the *Interim Construction Noise Guideline,* (DECC 2009) at one residential receptor, which is R17, by 5 dB(A). This is attributed to the construction of the new mine site intersection on the Mid Western Highway in the vicinity of this residence. Considering this, it is important to note that NMLs are not a criterion (as are operational noise limits), but a trigger for when construction noise management is to be considered and implemented.

Construction management and mitigation measures will be detailed in the Construction Environmental Management Plan (CEMP) to be prepared for the mine development.

Following site establishment, the initial development of the mine will include the construction of two amenity bunds at the southern end of the project area; the pit amenity bund, and the southern amenity bund, which is the southern face of the waste rock emplacement (refer to Figure ES3). The amenity bunds will be constructed during Year 1 to Year 4 of the project and will serve as both noise and visual barriers between the mine development and residential receptors in Kings Plains. The time to construct these bunds will be dependant in part on weather conditions during their construction.

Where noise enhancing weather conditions occur, particularly at night-time, operations may be limited on the southern face and will have to move to the northern end of the emplacement. Regis will proactively manage activities on these amenity bunds in consideration of real-time noise monitoring and weather conditions so that the bunds can be constructed as quickly as possible and in accordance with the noise predictions in the noise and vibration impact assessment of the project. Once constructed, the bunds will effectively shield the Kings Plains settlement from views of active mining operations.

Notwithstanding, the operational noise asssessment predicts that 15 residences in Kings Plains will experience noise levels that exceed the Project Noise Trigger Levels[1] (PNTLs) during the early few years of the mine development, such that they will be entitled to the implementation of voluntary mitigation measures upon request. These residences are R17, R19, R21, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, and R34, as shown in Figure 10.1 (refer to Chapter 10). Alternatively, Regis may enter into an agreement with these landholders. Importantly, these exceedances will be temporary, and will reduce to within 2 dB of the PNTLs by Year 4, as a result predominantly of the amneity bunds being in place by this time. It is noted that receptor R38 is also predicted to experience noise levels such that voluntary mitigation rights will apply, taking the total to 16 residences; however, Regis have negotiated an option with the landholder to purchase this property upon recept of project approval.

The sleep disturbance assessment concluded that the predicted noise levels at sensitive receptors are below those likely to cause awakenings. In relation to the proposed blasting activities at the mine, blasts will be limited to a maximum instantaneous charge (MIC) of 300 kg, so that no exceedances of the relevant criteria for air blast overpressure and ground vibration are predicted to occur at any nearby residential receivers or heritage items.

Road traffic noise relating to vehicle movements on Dungeon Road and the Mid Western Highway are not predicted to exceed the assessment or relative increase criteria at any of the houses near these roads.

ES4.1.5 Air quality

A network of air quality and meteorology monitoring equipment has been established by Regis within and around the mine project area. It consists of a High Volume Air Sampler (PM_{10}), dust deposition gauges and a meteorological monitoring station.

The design of the mine development incorporates a range of dust mitigation measures. A review of dust control measures was undertaken for the mine development, and this identified that the proposed mitigation and management measures will be in accordance with accepted industry best practice. Based on the modelling predictions, the proposed mitigation measures will effectively control emissions from the mine to minimise impacts on the surrounding environment.

1 The Project Noise Trigger Level is defined in the NSW Environment Protection Authority's *Noise Policy for Industry* (2017) as the level that provides a *benchmark* or *objective* for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures.

Dispersion modelling was undertaken for four stages over the proposed life of the mine. The results of the modelling show that, for all assessed stages of the mine development and operation, the predicted concentrations and deposition rates for particulate matter (TSP, PM_{10}, $PM_{2.5}$, dust deposition, metals and metalloids) and gaseous pollutants (NO_2 and HCN) are below the applicable impact assessment criteria at neighbouring privately owned residences.

Cumulative impacts were assessed by combining modelled mine-related impacts with recorded ambient background levels. The cumulative results also demonstrated compliance with applicable impact assessment criteria, despite a range of conservative assumptions in the emission calculations and dispersion modelling techniques, at all receptors apart from R38 which indicated one exceedance in Year 4 of the project. As noted, Regis have negotiated an option with the landholder to purchase this property upon receipt of project approval.

ES4.1.6 Greenhouse gas

The likely greenhouse gas (GHG) emissions from the mine development will be minimal, only making minor contributions to the total GHG emissions from NSW and Australia. Annual average total GHG emissions (Scope 1, 2 and 3) to be generated by the mine represent approximately 0.095% of total GHG emissions for NSW and 0.026% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2017.

ES4.1.7 Terrestrial biodiversity

Vegetation within the project area, which has experienced a long history of pastural use, mainly comprises open paddocks with some fragmented patches of timbered natural vegetation scattered throughout.

The terrestrial biodiversity assessment included preliminary vegetation mapping and surveys carried out by Envirokey between May 2013 and April 2017. EMM completed additional detailed tasks to further inform the terrestrial biodiversity assessment which included vegetation mapping, additional plot and transect data and completion of targeted flora surveys.

The majority of the project area was found to be dominated by open grasslands of varying condition and quality. Most of these areas have been heavily impacted by pastoral activities and are dominated by exotic plant species. Notwithstanding, four Plant Community Types (PCTs) were identified across the mine disturbance footprint:

- PCT 1330: Blakely’s Red Gum Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, which is listed as an Endangered Ecological Community (EEC) under the NSW *Biodiversity Conservation Act 2016* (BC Act);
- PCT 727: Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion;
- PCT 951: Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion; and
- PCT 766: Carex sedgeland of the slopes and tablelands.

Avoidance and minimisation of impacts on biodiversity have been applied as guiding principles in the design of the mine development. Ecological investigations completed between 2013 and 2019 have enabled a comprehensive knowledge of the project area’s biodiversity and areas of low constraint to be identified.

Following all measures to avoid, minimise and mitigate impacts, the mine development will result in the following residual impacts:

- removal of 132.36 ha of native vegetation and fauna habitat, of which:

- 129.3 ha comprises habitat for the Squirrel Glider, listed as Vulnerable under the BC Act listed;
- 75.77 ha comprises habitat for Koala, listed as Vulnerable under the BC Act and EPBC Act;
- 44.22 ha (PCT 1330) represents White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act; and
- 18.5 ha represents White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The area of White Box Yellow Box Blakely's Red Gum Woodland to be cleared by the mine development represents a 3.9% reduction in this vegetation community listed under the BC Act, and a reduction in 1.68% of CEEC listed under the EPBC Act, within a 5 km buffer of the mine project area. These impacts will be compensated through the implementation of the project's biodiversity offset strategy.

Offset calculations have been undertaken in accordance with *Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014) (FBA) to determine the number of credits required to compensate for the mine development's residual impacts and enable a net positive effect on biodiversity.

The mine development requires 5,927 ecosystem credits to compensate for residual impacts on plant community types (PCTs) and their associated threatened species. In addition to ecosystem credits, the mine development also requires 1,970 species credits for the Koala and 2,845 species credits for the Squirrel Glider. Regis will compensate for these residual impacts through the implementation of a biodiversity offset strategy developed in accordance with the FBA.

Regis will meet the offset obligation through one, or a combination of, the following actions:

1. establishment of a biodiversity stewardship site, managed under a stewardship agreement; and/or
2. purchase and retire credits available on the biodiversity credit register; and/or
3. payment into the Biodiversity Conservation Trust.

Regis is currently completing preliminary assessments of a property which it has recently purchased to determine its suitability as a biodiversity stewardship site. The potential stewardship site is located approximately 3 km south-west of Blayney. The site provides good value as a potential stewardship site, with large areas supporting Box Gum Woodland that meet the condition criteria in the Commonwealth listing advice for the community (PCT condition code high). This site would provide a suitable offset for the project and satisfy the requirements for a direct offset in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC 2012).

ES4.1.8 Aquatic ecology

The aquatic assessment involved detailed desktop review, literature review and field surveys. It included the assessment of 15 sites across four waterways, including the Belubula River and associated tributaries. Twelve of these sites were in the mine project area and three outside of the project area, at the junctions of the Belubula River and the Midwestern Highway, Newbridge Road and Hobby Yards Road.

The mine development is unlikely to impact threatened aquatic species, populations or ecological communities listed under the *Fisheries Management Act 1994* (FM Act) and EPBC Act. This is because waterways in the mine project area are unlikely to contain habitat which support these fish species.

Additionally, impacts to riparian vegetation are anticipated to be minor and local to the project area. Although temporary erosion and degradation of riparian zones is anticipated, this is unlikely to impact significant riparian vegetation and habitat, including threatened riparian species or communities listened under the EPBC Act.

While the assessment found aquatic habitat in the mine project area is unlikely to support threatened species habitat, including habitat to support breeding or migration, due to low level of connectivity between pools and the highly disturbed condition of the aquatic environment, the majority of surveyed sites were still classified as Type 1 highly sensitive key fish habitat due to the presence of aquatic habitat features such as instream aquatic vegetation and in channel debris. The mine development will result in the direct impact of removal of key fish habitat associated with the Belubula River within the disturbance footprint.

An aquatic ecology offset program will be prepared and implemented to offset the loss of key fish habitat in the mine disturbance footprint, so that there is a net gain in aquatic biodiversity outcomes of the mine development.

ES4.1.9 Aboriginal heritage

An Aboriginal cultural heritage assessment was carried out by Landskape (2019), finding a total of 38 aboriginal heritage sites in the mine project area. Twenty three of the sites found are in the footprint of either the open cut area, tailings storage facility, waste rock emplacement area or surface infrastructure and therefore will be directly impacted by land disturbance. These sites will be salvaged prior to land disturbance. Disturbance to a further 10 sites may occur as they are within close proximity to these areas and sit within the overall disturbance footprint identified for the project.

Landskape (2019) assessed the scientific, educational and aesthetic significance of the sites as low and the significance to the Aboriginal community as moderate. Disturbance to these sites will not greatly impact the Aboriginal heritage value of the mine project area or region or cause cumulative impact, considering the implementation of management measures outlined in Chapter 15.

A Cultural Heritage Management Plan (CHMP) will be prepared to guide the mitigation and management of sites in the mine project area and to avoid inadvertent impacts. The CHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains.

ES4.1.10 Historical heritage

No listed heritage items occur within the mine project area. Notwithstanding, eight sites deemed to be of local significance were identified in the direct footprint of the mine development. A further four locally significant sites were found within buffer areas around the direct disturbance footprint and may therefore be subjected to some level of disturbance. The sites identified are representative of pastoral and mining activities of the late nineteenth century. They comprise historic dwellings and dwelling ruins, mining sites (shafts, an adit and a survey marker tree), domestic and pastoral refuse dumps, small bridges and pastoral sites (sheds, stockyards).

One site located in the disturbance footprint of the proposed secondary water management facility (MGP-H23, the Hallwood Farm Complex) has been identified as possibly holding high historical, associational, aesthetic and technical values.

Landskape (2019) concluded that with the exception of Hallwood Farm Complex, the disturbance to the sites in the mine project area would not greatly impact the historical heritage value of the project area or region or cause cumulative impact, considering the implementation of recommended management measures (described in Section 16.5). A range of mitigation and management measures will be implemented to appropriately manage the sites identified in the mine project area. These measures include some further subsurface testing at two sites, archival recording and/or salvaging for others, and the fencing of some sites outside of the disturbance footprint to ensure no inadvertent impacts occur.

A CHMP will be prepared to guide the mitigation and management of sites in the mine project area and to avoid inadvertent impacts. The CHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains.

Further research will be conducted to confirm the significance of this site particularly in relation to the building fabric and technical details of the Hallwood dwelling, and the mitigation and manage measures for this site will then be updated accordingly as part of the preparation of the CHMP. Consultation with Cabonne Shire Council revealed that the Cabonne LEP includes heritage items based on a community-based heritage study in 2006 wherein Cabonne residents were invited to identify items of value to the community. This study and the subsequent LEP of 2012 did not receive any representations for Hallwood to be incorporated as a locally significant item.

ES4.1.11 Traffic and transport

The traffic assessment examined the potential impacts on the safety and efficiency of the local and regional road network as a result of the mine development. It identified no significant adverse impacts as a result of traffic movements to be generated by the mine development during both the construction and operation phases.

All vehicles will access the mine site via a new access road off the Mid Western Highway, which will be designed to safely accommodate project-related traffic volumes. The intersection will be designed and constructed with turn treatments to a greater standard than those determined using the Austroads Guide.

Fog-activated warning signs are proposed to be installed in consultation with NSW Roads and Maritime Services on the Mid Western Highway in advance of the new access intersection to reduce potential traffic conflicts/accidents. No other road or intersection upgrades will be required. A traffic management plan including a drivers' code of conduct will be developed to control project-related traffic movements and driver behaviour within the mine project area and on the surrounding road network.

ES4.1.12 Hazard and risk

The hazard and risk assessment considered if the mine development would be a hazardous or offensive development as defined under the *State Environmental Planning Policy No 33 (hazardous and Offensive Development (*SEPP 33*).* A preliminary hazard analysis workshop and subsequent assessment was therefore carried out for the project in accordance with clause 12 of SEPP 33 (Risk Mentor 2019, refer to Appendix R). This assessment concluded that the development does not constitute a hazardous or offensive development in accordance with SEPP 33.

The assessment considered the likely risks to public safety and provides measures to the mine development design to minimise and avoid impacts to people, property and the environment. The assessment evaluated several items associated with the project including storage and transport of dangerous goods and materials, bushfire risks and geochemical hazards and risks.

All potentially hazardous materials will be stored onsite away from disturbance boundaries to prevent any impact to members of the public. The magazine is located more than 2,200 m from the nearest sensitive receiver (ie privately owned dwelling) and over 1,000 m from the open cut, processing plant and administration areas. The diesel and LPG storages will be located separately to prevent unwanted interaction. These storages will also be located away from ignition sources, including machinery and vegetation.

Explosives will be stored in a magazine facility designed to meet the separation and design requirements in *AS2187.2 2006 Explosives – Storage, Transport and Use*. Sodium cyanide will be stored in accordance with the International Cyanide Code. The compound will be dry, bunded, locked and remote from any flammable materials. Liquid form sodium cyanide will be stored in bunded tanks and rated and labelled pipelines.

Regis will prepare a hazardous materials management plan which will describe the measures that will be implemented to ensure the safe handling, storage and transportation of hazardous materials used onsite. This plan will also document appropriate emergency procedures.

In relation to bushfire risk, the eastern boundary of the mine project area and the Vittoria State Forest, north-east of the project area, are mapped as bushfire prone. A bushfire management plan will be prepared and implemented for construction, operation and decommissioning, which will govern the implementation of the above listed management measures.

ES4.1.13 Visual amenity

Generally, there will be a high level of visual impact as a result of the mine development to sensitive receptors in the Kings Plains settlement, rural residences and the Mid Western Highway up to Year 4 following the completion and progressive rehabilitation of the southern amenity bund. A number of rural residences to the east and west of the mine project area will also experience high levels of visual impact during the initial stages of the mine development.

Following completion of a number of strategic on-site mitigation treatments and rehabilitation establishment, visual effects will be reduced but will remain moderate to high for many components over the life of the mine where there are direct views onto operational components. This reduction will be significant in the long term as the new post mining landforms become integrated with surrounding rural landscape character via micro-topographic design and careful rehabilitation tree planting patterns.

Importantly, the mine schedule has been designed to construct to the southern face of the waste rock emplacement as quickly as possible, so that this face will act as a bund to shield views of the active mining operations from the closest residence to the mine project area in Kings Plains.

Night-lighting from the mine infrastructure area and movement of mine fleet will contribute significantly to the sky glow in this existing dark sky locality. Distance will reduce the visual impacts from more distant sensitive view locations in the west as it becomes part of the greater sky glow prevalent around Blayney.

ES4.1.14 Social impact

A social impact assessment (SIA) was prepared by Hansen Bailey for the project in accordance with the *Social Impact Assessment Guidelines for State Significant mining, petroleum and industry development* (DPE 2017) (the SIA guidelines). The assessment identified the potential impacts and opportunities associated with both the construction and operational phases of the development, as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

The mine development will result in benefits to the local and regional communities, as well as resulting in a number of social impacts. The SIA found that the most significant social impacts predicted to occur will accrue to residents in closest proximity to the mine project area, particularly within the settlement of Kings Plains. The potential significant opportunities associated with the mine development will accrue largely to the broader Blayney LGA.

The SIA found that the area within around 2 km of the mine development, and particularly the Kings Plains locality, will experience a number of social impacts as a result of the construction and operations phases of the mine development. These impacts relate to a range of factors including changes in rural amenity and potential outmigration of residents. The most significant social impact of the mine development on the residents close to the mine project area is anticipated to be elevated noise levels particularly during the first few years (from Year 1 up to Year 4 of the project) prior to the completion of the southern amenity bund, and a change in the landscape due to the construction of the waste rock emplacement and the removal of the top of McPhillamys Hill as the open cut is mined.

As described in Chapter 6 (project evolution), Chapter 10 (noise) and Chapter 19 (visual), an extensive amount of work has been undertaken to ensure all reasonable and feasible measures have been implemented into the project design to avoid and/or reduce amenity related impacts on the Kings Plains community.

A range of mitigation measures have been proposed to mitigate and or manage the social impacts associated with the mine development, as described in Chapter 20.

The mine development will provide substantial direct and indirect employment opportunities, which will in turn provide a significant boost to the regional economy. The Blayney LGA in particular will benefit from investment in community infrastructure and services made possible through a Voluntary Planning Agreement (VPA) between Regis and the council, investment in education and training as Regis seeks to build a local skill base to support labour supply for the project, project procurement spend as Regis is committed to supporting local businesses to participate in the project procurement process, and direct and indirect population growth.

ES4.1.15 Rehabilitation

The areas to be disturbed by mining and infrastructure use will be progressively rehabilitated to a range of LSC classes, from class 4 to class 8. The majority of rehabilitation will target an agricultural (grazing) final land use. The upper slopes of the final void will be battered back to ensure a safe and stable landform remains post mining.

Progress on rehabilitation will be monitored annually and the results will be reported within the annual review. Final rehabilitation and closure requirements will ultimately be developed as part of a detailed closure plan, which will be produced within five years of closure in consideration of input from key government agencies, relevant stakeholders (including the nearby community) and applicable guidelines and standards at the time.

ES4.2 Pipeline development

ES4.2.1 Soil and land resources

The soil and land assessment for the pipeline involved a desktop assessment of potential impacts including erosion and sedimentation, acid sulphate soils, salinity, disturbance of contaminated soils, and naturally occurring asbestos.

The pipeline development will temporarily impact on soil and land resources along the 90 km corridor, predominantly through the excavation of soils for the laying of pipe in a trench. Erosion and sediment control practices will be adopted during construction of the pipeline in accordance with the Blue Book, Volume 1 (Landcom 2004) and Volume 2 (DECC 2008). These measures will be documented in the CEMP for the pipeline.

ES4.2.2 Water resources

The water assessment conducted for the pipeline development involved a desktop assessment to collate water quality, flow, groundwater and flooding data, which was used to prepare a surface water, groundwater and flooding assessment of the pipeline development. A geomorphology assessment was also conducted, involving a field assessment of 20 watercourse crossings to assess geomorphic attributes and stability.

The pipeline corridor traverses seven water catchments, with eight permanent watercourses crossed by the pipeline in six of the eight catchments. The pipeline will cross a total of 112 drainage lines, most of which are ephemeral minor streams and gullies that only flow after large rainfall events.

The potential for impacts to major watercourses traversed by the pipeline corridor has been avoided through design of the pipeline construction methodology; Macquarie River and Queens Charlottes Creek (Vale Creek) will be underbored to protect stream flows and to minimise disturbance to shallow groundwater.

Construction activities are not expected to interfere with groundwater resources or quality as trenching will typically be relatively shallow (1.3 m to 2 m) compared to the likely depth of the water table (generally >10 mbgl). It is unlikely then that the work will intercept groundwater aquifers or their flow systems.

The exception to this is the quaternary sandy alluvium associated with major river and creek crossings. The alluvium is unconsolidated and relatively thin (less than 15 m thick) but groundwater levels can be high with water tables generally 1.5–3 mbgl. Consequently, and as mentioned, underboring of the pipeline is proposed at the Macquarie River and Queens Charlottes Creek (Vale Creek). Underboring will allow the pipeline to be specifically positioned at the base of the alluvium or into the weathered rock profile so as to not affect groundwater flows or water quality.

The construction of the pipeline is expected to have negligible impacts on water flows due to the immediate backfill and rehabilitation of disturbed areas once the pipeline is laid. To avoid impacts to surface water quality, and as described above in ES4.2.1, erosion and sediment controls will be installed and maintained prior to the start of the construction activities in accordance with the Blue Book to protect local watercourses from impacts relating to erosion and the resulting sedimentation.

During commissioning, the pipeline will be pressure tested and monitored for any leaks. To minimise the risk of uncontrolled discharge to the environment only high-quality water will be used for pressure testing. Emptying of the pipeline will occur at scour valves located at intermediate low points along the alignment. Water will be removed via tanker trucks and taken to an appropriate storage location within the pipeline corridor or to the McPhillamys mine project area at Blayney.

Periodic monitoring of water quality is proposed along the pipeline corridor at permanent stream crossings. During operation, isolation or section valves will isolate the pipeline into discrete sections and allow individual sections to be dewatered for maintenance, or to provide security in an event such as a pipeline leak. Isolation valves will be installed on either side of major watercourse crossings.

The likelihood of a pipeline leak will be reduced through detailed modelling of pipeline pressures during detailed design, together with quality assurance and checking during the post construction. Periodic inspections and leak detection monitoring will be part of the ongoing operation and maintenance procedures.

ES4.2.3 Noise, vibration and blasting

The majority of the pipeline corridor traverses rural and rural residential land, with the potential for low levels of background noise. It also travels through a number of State Forests and some areas of native woodland vegetation. At the eastern extent of the pipeline development the corridor passes through highly disturbed land used for mining and power generation at Angus Place, SCSO and MPPS.

Potential noise sensitive receivers for the pipeline development are considered to be the receivers within 1 km of the pipeline corridor. Approximately 297 noise sensitive receivers have been identified along the pipeline corridor, the majority of which are residential properties. Noise levels at the identified receivers were calculated for a worst-case scenario of all construction equipment operating simultaneously. In reality this is unlikely to occur, and therefore the results presented in this EIS for noise predictions along the pipeline corridor during construction are conservative.

The construction noise levels for most activities associated with the pipeline installation have the potential to be above the relevant noise criteria (or noise management levels (NMLs)) at most receivers in close proximity to the corridor, although for the most part is expected to be only for a short duration. Assuming a construction rate of 40 - 80 m per day in rocky conditions (such as forestry tracks) and up to 600 - 650 m per day in open farmland, the potential for noise impacts at each identified receiver is not expected to occur for more than two weeks. Given the mobile nature of construction activities for the majority of the corridor, it is expected that sensitive receptors will only be exposed to elevated noise levels for relatively short periods.

Negotiation and notification with landholders, proactive management and adoption of specific onsite construction noise attenuation measures, limiting or staggering hours of construction, avoidance of out-of-hours work and / or adoption of alternative construction methods for managing and minimising impacts (including out-of-hours impacts) in accordance with the Noise and Vibration Assessment (Appendix AA) will be required.

The highly affected NML specified in the *Interim Construction Noise Guideline* (ICNG) (DECC 2009) of 75 dBA is expected to be satisfied at all receivers except at one (R48 on Pipers Flat Road in Portland) during transient pipeline construction activities, which will include clearing, grading, trenching and backfilling. This house is within 50 m of the pipeline corridor. In accordance with the requirements of the ICNG, respite periods may be required for this property.

Although construction noise will generally be temporary and localised in nature, the potential impacts will be managed through the implementation of noise control measures outlined in Chapter 25, particularly during noise intensive works when they are in close proximity to houses (<200 m).

Operational noise emissions from the pumping station facilities and pressure reducing system are anticipated to be negligible at adjacent receivers to each site, although this assumes some form of container or enclosure is adopted for each pumping station facility.

Noise management and mitigation measures will be implemented during the construction of the pipeline development. These measures will be documented in the CEMP.

ES4.2.4 Air quality and greenhouse gas

In relation to air quality, impacts will be minimal and temporary; generally limited to around 1-2 days at each location during the laying of the pipeline.

In order to assess the air quality impact potential of the proposed construction phase of the pipeline, a qualitative impact assessment has been undertaken. While no specific methodology for such an assessment is available in Australia, the United Kingdom-based Institute of Air Quality Management (IAQM) has prepared the *Guidance on the Assessment of Dust from Demolition and Construction* (hereafter GADDC, IAQM 2014). The GADDC has been applied for construction projects in NSW and accepted by the EPA as a progressive approach to assessing the particulate matter impact risk associated with short-term construction and demolition projects.

The assessment found the risk of dust impacts to human health and ecological receptors from the demolition, construction and truck trackout phases of the pipeline construction, prior to the application of dust mitigation measures, ranges between negligible and low. The assessment found there was a medium risk of dust soiling impacts as a result of earthworks without the implementation of mitigation measures. Accordingly, dust management measures will be documented in the CEMP.

GHG emissions from the pipeline development will principally be associated with energy consumption, specifically diesel combustion during the construction phase and consumption of purchased electricity by pumping stations during the operational phase. Due to the temporary nature of construction and the relatively small power requirements during operation, the GHG emissions from the pipeline will be negligible.

ES4.2.5 Biodiversity

The biodiversity assessment was initially conducted using desktop database searches, literature reviews, photographs and maps, previous studies carried out in the locality and consultation with representatives of relevant government, landowners and other stakeholders. The results of this desktop assessment were used to plan the initial route of the pipeline corridor.

The information available on biodiversity values was then supplemented by field surveys which were carried out in August, September, October and December 2018, and January and May 2019. The results of these field surveys resulted in many changes to both the route and the width of the pipeline corridor.

The pipeline route was originally planned to largely follow the APA gas pipeline easement and Transgrid easements; however, once the utilities advised that the pipeline development would need to lie beyond the boundaries of their easements, it became clear that this would involve significant removal of native vegetation. In addition, part of the route near the Sunny Corner State Forest which would have provided better gradients for the pipeline was abandoned due to the significant presence of the host plants (*Bursaria spinosa*) of the Purple Copper Butterfly. The final selection of the pipeline route has therefore been an iterative process informed by field surveys and landscape and habitat values to avoid impacts as far as possible.

The final alignment chosen means that the pipeline corridor generally traverses large extents of cleared agricultural land and timber plantations of Radiata Pine. Where possible, the pipeline will be trenched into existing roads and tracks, minimising impact to native vegetation and threatened species habitat. Further, impacts to threatened fish distribution and key fish habitat in the Macquarie River and Queen Charlottes Creek will be avoided by underboring rather than trenching.

Twelve Plant Community Types (PCT) have been identified within the proposed alignment of the pipeline corridor, totalling 8.51 hectares in extent. Vegetation conditions range from poor to good along the corridor, with several PCTs occurring in three condition states.

One BC Act listed threatened ecological community (EEC) was identified in the corridor; White Box Yellow Box Blakely's Red Gum Woodland EEC. Clearing at pumping station facility No.4 will permanently remove 0.175 ha of this vegetation type. With about 66.88 ha within the study area, this represents approximately 1.7 % of the known EEC within the study area being directly impacted and 0.3 % being permanently cleared.

One EPBC Act listed critically endangered ecological community (CEEC), White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Grassland community, comprising an area of 0.28 ha of moderate condition vegetation also occurs within the pipeline corridor at the site of pumping station facility 4. With about 33.3 ha of the CEEC in the study area, this represents a 0.8 % removal of the CEEC in the study area.

Six threatened species listed under the BC Act were recorded during the field survey: Gang Gang Cockatoo; Dusky Woodswallow; Spotted Harrier; Little Eagle; Flame Robin; and Capertee Stringybark.

Seven BAM species credit species were also assumed to be present within the pipeline corridor for the purposes of impact assessment and the calculations of required biodiversity offset credits, where targeted surveys were not conducted in suitable habitat or due to the low likelihood of detection based on climatic conditions at the time of the survey. These species are: Eastern Pygmy Possum; Southern Myotis; Purple Copper Butterfly; Squirrel Glider; Brush-tailed Phascogale; Silky Swainson-pea; and Austral Toadflax.

The assessment also identified that one threatened fish species (Purple spotted Gudgeon) could be impacted by the pipeline development. However, the BC Act test of significance for this species indicates that there will be no significant impact as a result of the pipeline development. Furthermore, the EPBC Act significant impact guidelines were applied to one EPBC listed CECC and ten EPBC listed threatened species. The pipeline development will not have a significant impact on any of these species or communities.

To offset the impacts of the pipeline development on native vegetation and threatened species, a total of 139 ecosystem credits and 293 species credits will be required. Accordingly, a biodiversity offset strategy will be prepared for the pipeline development, which will be included in the overarching biodiversity offset strategy for the project, including the mine development.

ES4.2.6 Aboriginal heritage

The Aboriginal Cultural Heritage Assessment identified seven Aboriginal heritage sites within the pipeline corridor. OzArk (2019b) assessed the archaeological/scientific, aesthetic and historical value of these sites as low. Based on feedback from the RAPs, the social or cultural value of all sites has been assessed as high.

All sites within the corridor will be salvaged by a surface collection of all visible artefacts prior to disturbance in the area.

An Aboriginal Cultural Heritage Management Plan (ACHMP) will be prepared to guide the management of sites in the pipeline corridor and avoid inadvertent impacts on sites located outside of the corridor. The ACHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains.

ES4.2.7 Historic heritage

The historic heritage assessment for the pipeline development found that no historic heritage items will be directly impacted by the pipeline development. Desktop searches of heritage databases identified 20 locally listed heritage items within 1 km of the pipeline corridor. None of these listed items are within the pipeline corridor; however, two of these items are directly adjacent to the pipeline corridor being:

- Leeholme Homestead and outbuildings listed on the Bathurst Regional LEP 2014; and
- Portland General Cemetery listed on the Lithgow LEP 2014.

The pipeline corridor does not intersect the curtilages of these heritage listed items and there will be no ground disturbance impacts outside of the pipeline corridor. There is the potential for these items to be indirectly impacted during construction without the implementation of appropriate management measures.

No visual impacts will occur on historic heritage items. The pipeline will be buried, except for the pumping station facilities and the pressure reducing system. The above ground structures of the pipeline development will not be within the visual curtilage of any listed heritage items.

ES4.2.8 Traffic and transport

The traffic assessment examined the potential impacts on the safety and efficiency of the local and regional road network as a result of the pipeline development. No significant impacts during construction are anticipated to occur on the operation or capacity of key regional, urban, local or unsealed roads and intersections providing access to each of the pipeline development construction sites.

Key regional roads will be underbored to avoid any impact to traffic using these roads. Queuing or delays may be associated with partial road closures to accommodate trenched road crossings; however, impacts will be limited to a duration of up to two days at any one location.

To mitigate any potential impacts on the road network, a Construction Traffic Management Plan (CTMP), will be prepared prior to construction of the pipeline as part of the CEMP.

ES4.2.9 Visual amenity

The visual assessment for the pipeline development included identification of key viewpoints (potentially affected receptors) based on site observations, aerial photography and mapping and analysis of the existing visual character in the vicinity of permanent infrastructure.

The visual assessment concluded that the pipeline development will not have significant visual impacts along the pipeline corridor. During the construction phase, impacts will be temporary and will move progressively along the corridor. The pipeline corridor will be mostly below ground once constructed, with only the pumping station facilities, pressure reducing system and valves visible above ground during the operational phase.

The pumping station facilities No.1, No.2 and No.3 will be located on existing mine and infrastructure sites which have a high visual absorption capacity. Pumping station facility No.4 will be near the Bathurst Bike Park and will be visible from public viewpoints in the area; however, it will be located within existing screening vegetation. Any further impacts during the construction and operation phase will be managed with additional mitigation measures.

ES4.2.10 Rehabilitation

The rehabilitation and closure strategy for the pipeline development is to ultimately create safe, stable and non-polluting landforms that are consistent with agreed post development land uses. Regis will ensure land disturbed by the pipeline is rehabilitated to an appropriate standard and representative of surrounding vegetation communities (including pasture) and is compatible with pe-disturbance and surrounding land uses. Rehabilitation will occur progressively and as soon as practical following completion of pipeline construction.

ES4.3 Economic assessment

The project is estimated to bring significant net social benefits to NSW of $141 million to $232 million (present value at 7% discount rate), the latter being inclusive of employment benefits. Therefore, the project is highly desirable and justified from an economic efficiency perspective.

The key driver of the net social benefits to NSW is revenue (reflecting production levels, the value of gold in USD and the AUD/USD exchange rate). Forecasts suggest that revenue estimates may be conservative in the economic assessment of the project, and hence the estimate of net social benefits may be conservative.

The relative magnitude of net production benefits and residual environmental, cultural and social impacts indicates that even with large changes to the assumed gold price, the net production benefits of the project to NSW are likely to still far outweigh any residual impacts of the project.

At a local level (within the Blayney, Cabonne, Bathurst and Orange LGAs), and based on the conservative assumption of full regional employment and no in-migration of labour, it is estimated that the project will contribute 136 direct local jobs ($12 million in income) to residents of the region during the peak year of construction and 89 direct local jobs ($8 million in income) annually during operation.

With flow-on effects included, the peak year of construction will contribute up to 337 in regional jobs and $24M in regional income to existing residents, and the project operation will contribute up to 263 regional jobs and $18M in regional net income to existing residents.

Allowing for less conservative employment assumptions (ie less than full employment in the region, job chain effects and in-migration of labour to the region), the project is anticipated to contribute 1,289 direct and indirect jobs during construction, and 788 direct and indirect jobs during operation.

From a national perspective, the net production benefits that are predicted to accrue to Australia are estimated at $347 million (present value at 7% discount rate), comprising $47 million in royalties, $98 million in company tax and $202 million in residual producer surplus. When environmental, social and cultural costs are accounted for, the project is estimated to provide net social benefits to Australia of between $345 million and $437 million (the latter incorporating the benefits of employment) and therefore, as is the case at the state level, is desirable and justified from an economic efficiency perspective.

ES5 Justification and conclusion

The McPhillamys Gold Project will provide a range of direct and indirect benefits to the local, regional and State economies over its 15 year life.

A number of technical investigations have been carried out to support this EIS. These assessments identified residual impacts of the project and appropriate mitigation measures to address these impacts. The residual impacts identified will mostly accrue to the residences closest to the mine project area, particularly in the settlement of Kings Plains. Mitigation measures for these impacts have been proposed particularly for noise, air and visual amenity, so that these residual impacts are reduced to an acceptable level.

The Blayney LGA in particular will benefit from the project as a result of investment in community infrastructure and services made possible through a VPA, investment in education and training as Regis seeks to build a local skill base to support labour supply for the project, and project procurement spend as Regis is committed to supporting local businesses to participate in the project procurement process.

Numerous alternative designs have been evaluated for both the mine and pipeline developments, based on extensive geological, environmental, financial and other technical investigations that have been undertaken over a number of years. This process has facilitated the development of a considered, well-designed project that will efficiently recover a highly valuable resource, while minimising environmental impacts and potential land use conflicts while delivering socio-economic benefits. The project has been assessed in accordance with the principles of Ecologically Sustainable Development in order for it to be considered for approval.

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REGIS
RESOURCES LTD

Chapter 1

Introduction

1 Introduction

1.1 Background

LFB Resources NL is seeking development consent for the construction and operation of the McPhillamys Gold Project (the project), a greenfield open cut gold mine and associated water supply pipeline in the Central West of New South Wales (NSW). The project application area is illustrated at a regional scale in Figure 1.1 and a local scale in Figure 1.2.

As shown in Figure 1.1, the project that is the subject of this Environmental Impact Statement (EIS) comprises two key components:

- the mine site where the ore will be extracted and processed (herein referred to as the mine development); and

- an associated water pipeline which will enable the supply of water from near Lithgow to the mine site (the pipeline development).

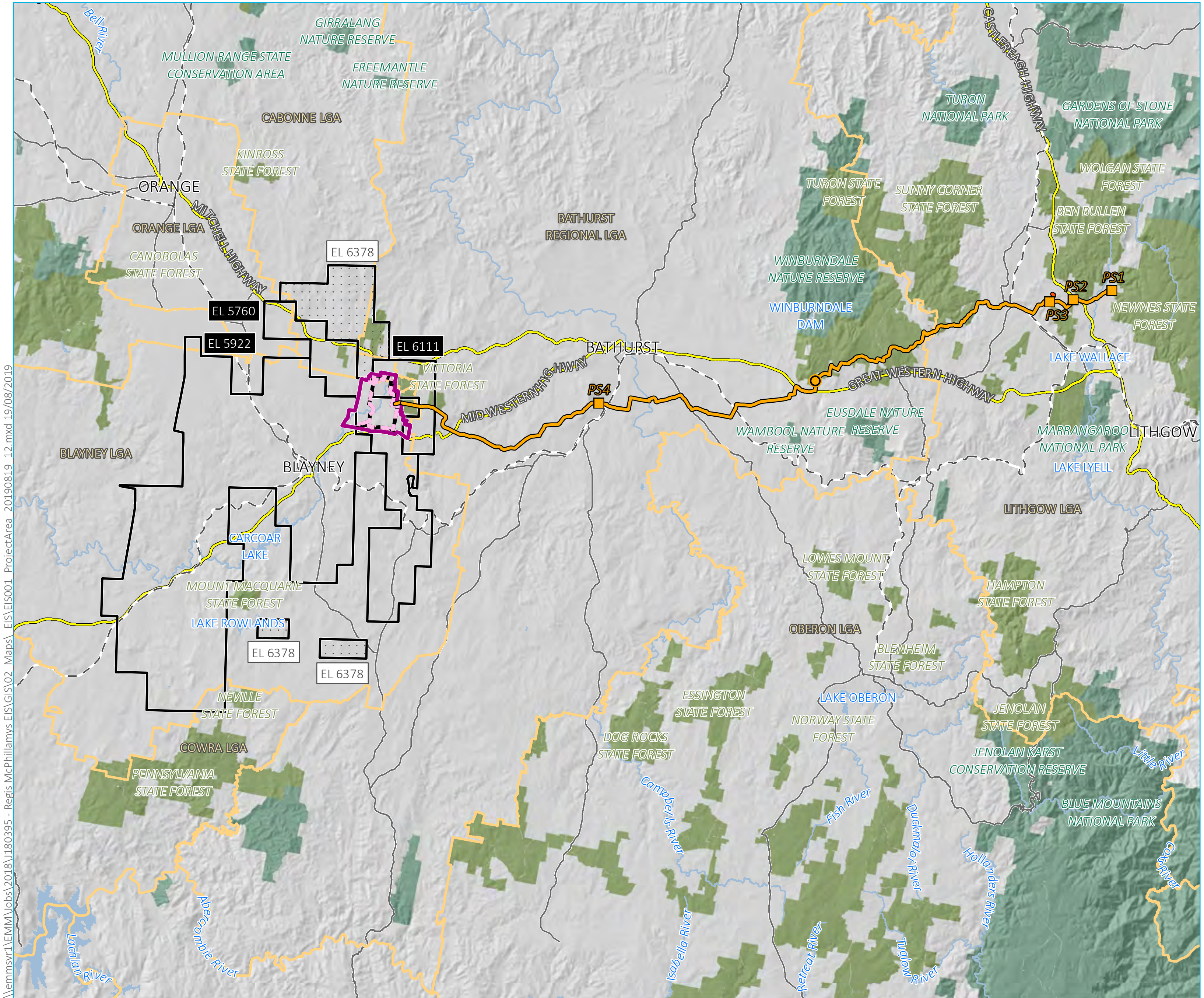
LFB Resources NL is a 100% owned subsidiary of Regis Resources Limited (herein referred to as Regis). Regis holds three exploration licences over the mine development component of the project. The mine development is predominately within exploration licence (EL) 5760, with the northern portion extending into EL 6111, and the south-eastern corner extending into EL 5922. The mine development project boundary (herein referred to as the mine project area) is illustrated in Figure 1.3.

The mine development is approximately 8 km north-east of Blayney within the Blayney and Cabonne local government areas (LGAs). This locality has a long history of alluvial and hard rock mining, with exploration for gold and base metals occurring since the mid to late 19th century.

More recently, between 2006 and 2009, exploration targeting gold mineralisation within EL 5760 was carried out by Newmont Exploration Pty Ltd and Alkane Resources Ltd (Newmont Alkane JV), leading to the discovery of the McPhillamys deposit. Additional exploration was carried out by Newmont Alkane JV in 2010 to further define the known mineralisation and metallurgical characterisation of the deposit which confirmed a potentially economic resource. Regis acquired EL 5760 in November 2012 and has since developed the project through detailed geological, environmental, financial and other technical investigations to define the resource and to identify and address environmental and other constraints.

The mine development is in the upper reaches of the Belubula River catchment, within the greater Lachlan River catchment. Water will be supplied to the mine via an approximate 90 km long pipeline, transferring surplus water from Centennial's Angus Place Colliery (Angus Place) and Springvale Coal Services Operations (SCSO), and Energy Australia's Mt Piper Power Station (MPPS) near Lithgow, to the mine. The supply of water from Angus Place, SCSO and MPPS will enable a beneficial use of otherwise surplus water and will provide a reliable water source for the project. The alignment of the water supply pipeline is illustrated in Figure 1.1 and described in detail in Chapter 2.

Numerous alternative designs have been prepared and evaluated for both the mine and pipeline developments, as discussed in detail in Chapter 6. This process has facilitated the development of a considered, well-designed project that will efficiently recover a highly valuable resource, while minimising environmental impacts and potential land use conflicts and delivering socio-economic benefits to the local and broader communities.



KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment
- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest
- Local government area

Exploration lease boundaries (of interest)
- Held by LFB Resources NL (Regis)
- Held by others

Source: EMM (2019); Regis Resources (2019); DPE (2018); DFSI (2017); GA (2011)

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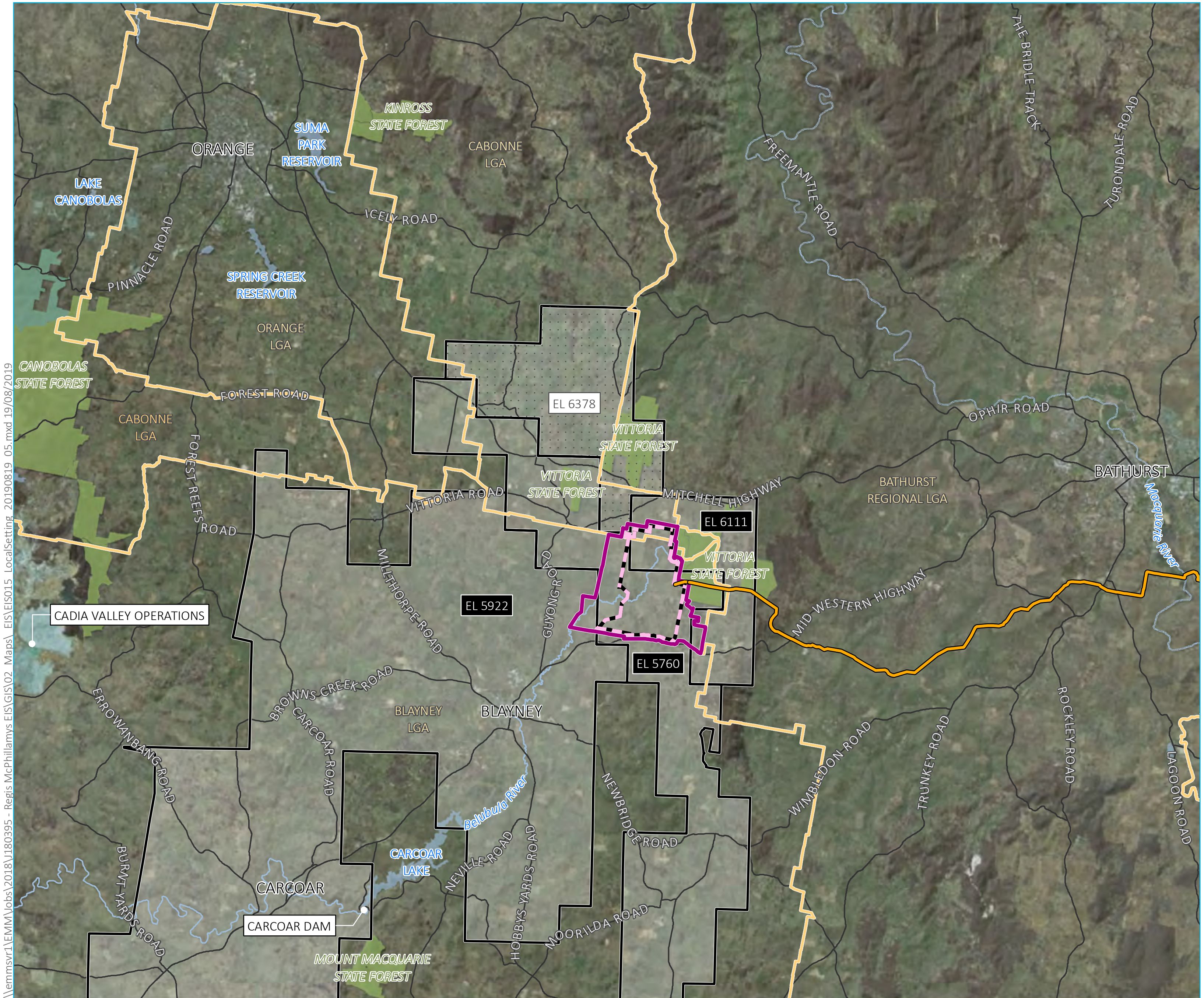
Regional setting - project application area

McPhillamys Gold Project
Environmental impact statement
Figure 1.1

REGIS RESOURCES LTD
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor

Existing environment

- Main road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Local government area

Exploration lease boundaries (of interest)

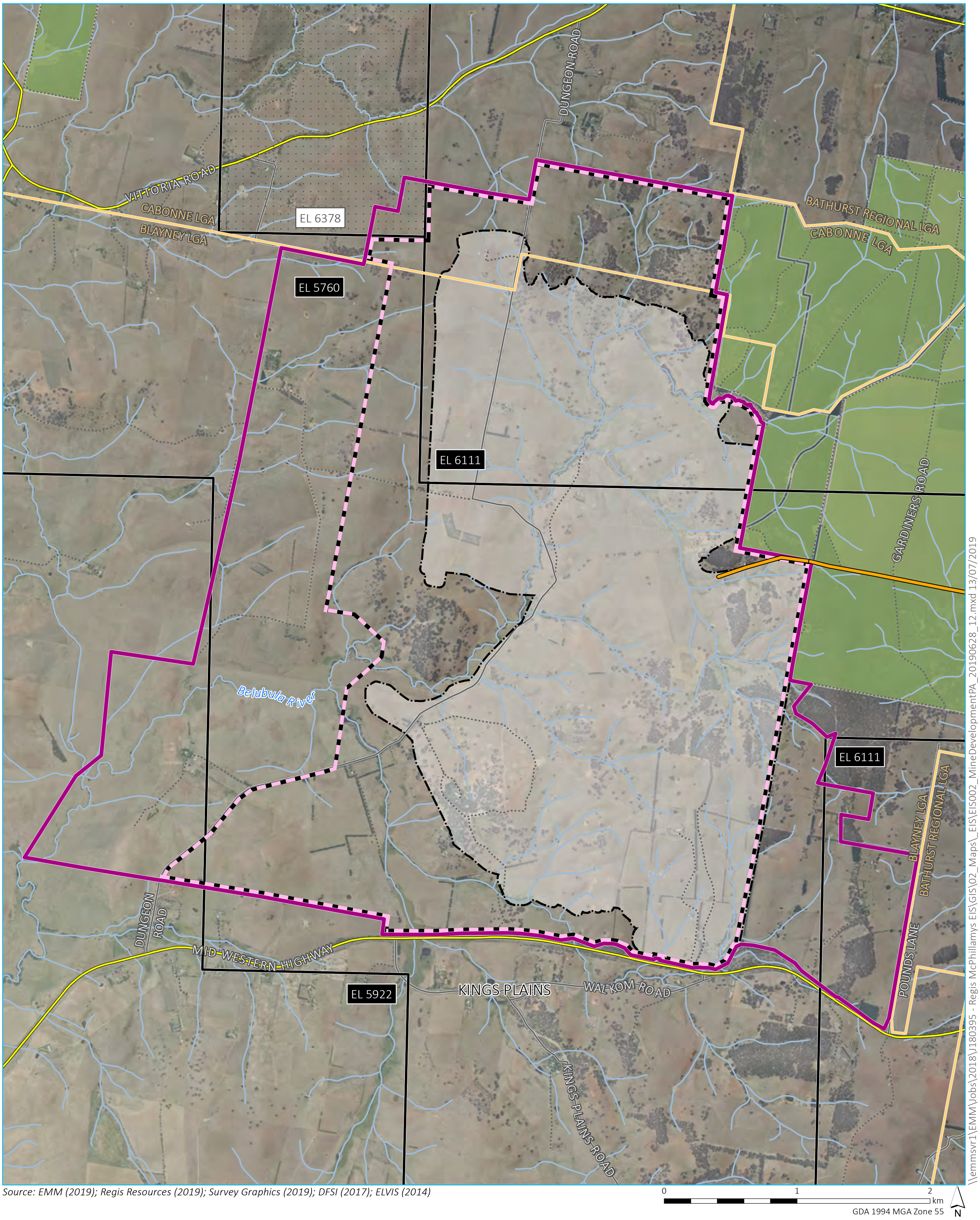
- Held by LFB Resources NL (Regis)
- Held by others

Local setting of the mine development

McPhillamys Gold Project
Environmental impact statement
Figure 1.2

REGIS RESOURCES LTD

EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Exploration lease boundaries (of interest)
- Held by LFB Resources NL (Regis)
- Held by others

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest
- Local government area

Mine development project area

McPhillamys Gold Project
Environmental impact statement
Figure 1.3

1.2 Project overview

A full project description is provided in Chapter 2. The key components of the project are as follows:

- Development and operation of an open cut gold mine, comprising approximately one to two years of construction, approximately 10 years of mining and processing and a closure period (including the final rehabilitation phase) of approximately three to four years, noting there may be some overlap of these phases. The total project life for which approval is sought is 15 years.

- Development and operation of a single circular open cut mine with a maximum diameter at the surface of approximately 1,050 metres (m) and a final depth of approximately 460 m, developed by conventional open cut mining methods encompassing drill, blast, load and haul operations. Up to 8.5 Million tonnes per annum (Mtpa) of ore will be extracted during the project life.

- Construction and use of a conventional carbon-in-leach processing facility with an approximate processing rate of 7 Mtpa to produce approximately 200,000 ounces, and up to 250,000 ounces, per annum of product gold. The processing facility will comprise a run-of-mine (ROM) pad and crushing, grinding, gravity, leaching, gold recovery, tailings thickening, cyanide destruction and tailings management circuits. Product gold will be taken off-site to customers via road transport.

- Placement of waste rock into a waste rock emplacement which will include encapsulation of material with the potential to produce a low pH leachate.

- The southern portion of the waste rock emplacement (southern amenity bund) and the pit amenity bund will be constructed and rehabilitated in the early years of the mine development to provide noise and visual bunds for the remainder of operations.

- Construction and use of an engineered tailings storage facility to store tailings material.

- Construction and operation of associated mine infrastructure including:

    - administration buildings and ablutions;

    - workshop and stores facilities, including associated plant parking, laydown and hardstand areas, vehicle washdown facilities, and fuel and lubricant storage;

    - internal road network;

    - explosives magazine and ammonium nitrate emulsion (ANE) storage;

    - topsoil, subsoil and capping stockpiles;

    - ancillary facilities, including fences, access roads, car parking areas and communications infrastructure; and

    - on-site laboratory.

- Establishment and use of a site access road and intersection with the Mid Western Highway.

- Construction and operation of water management infrastructure, including water management facilities (such as a raw water storage dam, primary and secondary water management facilities), clean water and process water diversions and storages, and sediment control infrastructure.

- A peak construction workforce of approximately 710 full-time equivalent (FTE) workers. During operations, an average workforce of around 260 FTE employees will be required, peaking at approximately 320 FTEs in around years four and five of the project.

- Construction and operation of a water supply pipeline approximately 90 km long from Centennial's Angus Place and SCSO; and Energy Australia's MPPS operations near Lithgow to the mine development project area. The pipeline development will include approximately four pumping station facilities, a pressure reducing system and communication system. Approximately 13 ML/day (up to a maximum of 15.6 ML/day) will be transferred for mining and processing operations.

- Installation and use of environmental management and monitoring equipment.

- Progressive rehabilitation throughout the mine life. At the end of mining, mine infrastructure will be decommissioned, and disturbed areas will be rehabilitated to integrate with natural landforms as far as practicable. The final landform, apart from the final void, will support land uses similar to current land uses or land uses consistent with land use strategies of the Blayney and Cabonne LGAs.

1.2.1 Terminology

The following terms are used throughout this EIS to describe the McPhillamys Gold Project:

- **the project** – the project in its entirety; encompassing the mine development and pipeline development;

- **project application area** – the area in its entirety to which the development application (SSD 9505) relates; comprising the mine development project area and the pipeline corridor as illustrated in Figure 1.1;

- **mine project area** – refers to the mine development project area as illustrated in Figure 1.2 and Figure 1.3;

- **pipeline corridor** – an approximate 90 km long pipeline alignment from Centennial's Angus Place and SCSO; and Energy Australia's MPPS near Lithgow to the mine project area, as illustrated in Figure 1.1;

- **mine development** – construction and operation of the mine and associated mine infrastructure within the mine project area; and

- **pipeline development** – construction and operation of the pipeline and associated infrastructure to transfer water to the mine development within the pipeline corridor.

1.3 Project objectives

The project seeks to meet the following objectives:

- to optimise the recovery of gold in the mine project area;

- to safely mine the economically extractable resource;

- to provide stable, secure employment to its workers and to generate economic activity and wealth for the local, regional and State communities; and

- to effectively manage impacts on surrounding residents and the local environment during construction and operations; achieving, at a minimum, compliance with relevant statutory requirements.

1.4 Purpose of this document

The project is State significant development (SSD) pursuant to Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP). Accordingly, approval is required under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the project, encompassing the mine development and associated mine infrastructure including the pipeline development.

This EIS has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Regis to support the SSD application for development consent under Section 4.12 of the EP&A Act for the project. It has been prepared to the form and content requirements set out in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The schedule of lands to which this EIS applies is provided in Appendix A.

The primary objective of this EIS is to inform government authorities and other stakeholders about the project and the measures that will be implemented to mitigate, manage and/or monitor potential impacts, together with a description of the remaining social, economic and environmental impacts. It addresses the environmental assessment requirements (EARs) issued by the Secretary of the Department of Planning and Environment (DPE, now the Department of Planning, Industry and Environment (DPIE)) on 19 December 2018.

The EARs and where they have been addressed in this EIS are provided in Table 1.1 and Appendix B. Additional agency assessment requirements from relevant statutory authorities are also provided in Appendix B, along with a table outlining where each requirement has been met in the EIS.

Table 1.1 McPhillamys Gold Project (SSD 9505) - EARs and where they have been addressed

Requirement	Location in EIS
General requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. In particular, the EIS must include:	
• a stand-alone executive summary;	Executive summary
• a full description of the development, including:	Chapter 2
– the geological setting and resource to be extracted, demonstrating efficient resource recovery within environmental constraints;	Section 5.2.1(v)
– the mine site and processing site layout and scheduling;	Section 2.4
– minerals processing;	Section 2.8
– surface infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process);	Section 2.1 and Section 2.11.4
– a waste (overburden, tailings, etc) management strategy;	Section 2.7 (waste rock), Section 2.9 (tailings), Chapter 21 (mine development and Chapter 34 (pipeline development).
– a water management strategy;	Section 2.10, Chapter 9 and Appendix J (mine development) and Chapter24 and Appendix X (pipeline development).
– a rehabilitation strategy;	Chapter 22 and Appendix U (mine development) and Chapter 35 (pipeline development).

Table 1.1 McPhillamys Gold Project (SSD 9505) - EARs and where they have been addressed

Requirement	Location in EIS
– the likely interactions between the development and any other existing, approved or proposed mining related development in the vicinity of the sites;	Section 5.4.1(v) and Chapter 37 (cumulative impacts).
• a strategic justification of the development focusing on site selection and the suitability of the proposed sites;	Part G (Chapter 39)
• a list of any approvals that must be obtained before the development may commence;	Chapter 3, Section 3.8.
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:	Part D (mine development) and Part E (pipeline development).
– a description of the existing environment likely to be affected by the development, using sufficient baseline data;	Chapter 5, Part D (mine development) and Part E (pipeline development).
– an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice;	Part D (mine development) and Part E (pipeline development).
– a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development, and an assessment of: ▪ whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented; ▪ the likely effectiveness of these measures; and ▪ whether contingency plans would be necessary to manage any residual risks; and	Part D (mine development) and Part E (pipeline development).
– a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	Part D (mine development) and Part E (pipeline development).
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS;	Chapter 38
• consideration of the development against all relevant environmental planning instruments (including Part 3 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*); and	Chapter 3, Section 3.5
• the reasons why the development should be approved having regard to: – relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development; – the biophysical, economic and social costs and benefits of the development; – the suitability of the sites with respect to potential land use conflicts with existing and future surrounding land uses; and – feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.	Part G, Chapter 39 (Justification) and Chapter 40 (Conclusion).
While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development.	The environmental planning instruments, guidelines, policies, and plans listed in Attachment 1 were considered in preparation of the environmental impact assessments provided in Chapters 7 to 36.
In addition to the matters set out in Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*, the development application must be accompanied by a signed report from a suitably qualified person that includes an accurate estimate of the	Provided separately to the DPE.

Table 1.1 McPhillamys Gold Project (SSD 9505) - EARs and where they have been addressed

Requirement	Location in EIS
capital investment value of the development (as defined in Clause 3 of the *Environmental Planning and Assessment Regulation 2000*), including details of all the assumptions and components from which the capital investment value calculation is derived.	
Key Issues	
• **Land** – including an assessment of:	
– the likely impacts of the development on the soils and land capability of the site and surrounds, and a description of the mitigation and management measures to prevent, control or minimise impacts of the development;	Chapter 7 and Appendix G (mine development). Chapter 23 and Appendix W (pipeline development).
– - the likely agricultural impacts of the development, including identification of any strategic agricultural land;	Chapter 8 and Appendix H (mine development). Chapter 23 (pipeline development).
– - the likely impact of the development on landforms (ie local topography), including the long term geotechnical stability of any new landforms proposed on site; and	Chapter 7 and Appendix G (Soil and Land Capability Assessment), Chapter 22 and Appendix V (Rehabilitation and Landscape Management Strategy), and Chapter 2, Section 2.6 (Open Cut Void design) and Appendix D (Tailings Dam Design Report).
– the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*, paying particular attention to the agricultural land use in the region	Chapter 3, Section 3.5.1.
• **Water** – including: – an assessment of the likely impacts of the development on the quantity and quality of surface, and groundwater, having regard to the NSW *Aquifer Interference Policy*;	Chapter 9 (Water resources), Appendix I (Surface Water Assessment) and Appendix J (Groundwater Assessment) (mine development). Chapter 24 and Appendix X (pipeline development).
– an assessment of the hydrological characteristics of the site and downstream;	Section 9.2 and Appendix J (mine development). Section 24.3 and Appendix X (pipeline development).
– an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure and systems and other water users, including impacts to water supply from Carcoar Dam, riparian and licensed water users, use and discharge of water during construction, commissioning and maintenance of the pipeline infrastructure;	Section 9.5, Appendix J and Appendix K (mine development). Section 24.4 and Appendix X (pipeline development).
– a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply and transfer infrastructure and water storage structures, and measures to minimise water use;	Section 9.4 and Appendix J.
– demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP);	Section 2.14, Section 9.3.1, Section 9.4.1, and Appendix J and Appendix X.
– a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; and	Section 2.14, Section 9.6, Appendix J, Appendix K and Appendix X.
– a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts;	Chapter 2, Section 9.2, Section 9.7, Appendix J and Appendix K (mine development). Section 24.5 and

Table 1.1 McPhillamys Gold Project (SSD 9505) - EARs and where they have been addressed

Requirement	Location in EIS
	Appendix X (pipeline development).
– a description of construction erosion and sediment controls, how the impacts of the development on areas of erosion, salinity or acid-sulphate risk, steep gradient land or erodible soils types would be managed and any contingency requirements to address residual impacts; and	Section 9.7, Appendix J (mine development). Section 2.15, Section 24.5 and Appendix X (pipeline development).
– an assessment of the potential flooding impacts of the project;	Section 9.5 and Appendix J (mine development). Section 24.4 and Appendix X (pipeline development).
• **Noise, Vibration and Blasting** – including:	
– an assessment of the likely operational noise impacts of the development (including construction noise) in accordance with the *Noise Policy for Industry NSW*, and the *Voluntary Land Acquisition and Mitigation Policy*;	Appendix L and Section 10.6.2 (mine development). Appendix AA and Section 25.5 (pipeline development).
– if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities in accordance with the *Interim Construction Noise Guideline*;	Section 10.6.1 and Appendix L: (mine development).
– an assessment of the likely road noise impacts of the development in accordance with the *NSW Road Noise Policy*; and	Section 10.6.3 and Appendix L (mine development) and Section 25.5.2 and Appendix AA (pipeline development).
– an assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guidelines;	Section 10.6.4 and Appendix L (mine development). Section 25.5.4 and Appendix AA (pipeline development).
• **Air Quality –** including:	
– an assessment of the likely air quality impacts of the development, including cumulative impacts from nearby developments, in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW, and having regard to the NSW Government's *Voluntary Land Acquisition and Mitigation Policy*; and	Chapter 11 and Appendix M (mine development). Chapter 26 (pipeline development).
– an assessment of the likely greenhouse gas impacts of the development;	Chapter 12 (mine development) and Chapter 26 (pipeline development).
– a description of the feasibility of measures that would be implemented to monitor and report on the emissions (including fugitive dust and greenhouse gases) of the development;	Section 11.5 and Chapter 12 (mine development). Chapter 26 (pipeline development).
• **Biodiversity** – including:	
– an assessment of the direct and indirect biodiversity impacts of the development throughout its life, and impacts on biodiversity values in the region, which: ▪ for the open cut mine is assessed in accordance with the Framework for Biodiversity Assessment; and includes a strategy to offset any residual impacts in accordance with the NSW *Biodiversity Offsets Policy for Major Projects*; and ▪ for the water supply pipeline is assessed in a Biodiversity Development Assessment Report in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method, and includes a strategy to offset any residual impacts in accordance with the *Biodiversity Conservation Act 2016* (NSW);	Refer to the BAR in Appendix N and summarised in this Chapter 13 which addresses the impacts of the mine development, has been prepared in accordance with the reporting and mapping requirements of the FBA and includes an offset strategy to offset residual impacts. A separate Biodiversity Development Assessment Report and offset strategy has been prepared for the water supply pipeline. The biodiversity development assessment report for the water pipeline is provided as Appendix Y to the EIS and summarised in Chapter 27.

Table 1.1 McPhillamys Gold Project (SSD 9505) - EARs and where they have been addressed

Requirement	Location in EIS
– an assessment of the likely impacts of the development on aquatic ecology and key Fisheries issues, including Aquatic Biodiversity and Key Fish Habitats;	A separate aquatic ecology assessment has been prepared to address likely impacts of the mine development on aquatic ecology and key fisheries issues. The aquatic assessment is provided as Appendix O and summarised in Chapter 14. Chapter 27 and Appendix Y (pipeline development).
– an assessment of impacts to koalas and koala habitat in accordance *with State Environmental Planning Policy No. 44 – Koala Habitat Protection*; and	Section 13.8.2 and Appendix N (mine development). Section 27.5.1 and Appendix Y (pipeline development).
– a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time;	Section 13.5.2 and Appendix N details the measures incorporated into the design to avoid and minimise impacts on biodiversity, and the proposed measures to manage biodiversity during construction and operation of the mine development. Section 27.6 and Appendix YY (pipeline development).
• **Heritage –** including:	
– an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with Aboriginal stakeholders having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010); and – an assessment of the impact on environmental heritage in accordance with the *NSW Heritage Manual*, including heritage conservation areas and State and local heritage items within and near the site, and detailed mitigation measures to offset potential impacts on Heritage values;	Chapter 15 and Appendix P addresses Aboriginal cultural heritage and Chapter 16 and Appendix P addresses historical heritage (mine development). Chapter 28 and Appendix Z addresses Aboriginal cultural heritage and Chapter 29 and Appendix Z addresses historical heritage (pipeline development).
• **Traffic and transport –** including:	
– an assessment of the likely traffic and transport impacts of the development on the capacity, condition, safety and efficiency of the road network and any cumulative impacts of other developments in the locality;	Chapter 17 and Appendix Q (mine development). Chapter 30 and Appendix BB (pipeline development.
– an assessment of the site access routes (including Mid Western Highway and Great Western Highway) and site access points in accordance with the *Roads Act 1993*; and	The Great Western Highway is addressed with regard to the pipeline development in Chapter 30
– a description of the measures that would be implemented to mitigate and / or manage potential traffic impacts including a schedule of all required road upgrades, road maintenance contributions, management of oversized and over mass traffic and other traffic control measures, developed in consultation with the relevant road authority (if required);	Section 17.4 and Appendix Q (mine development). Section 30.5 and Appendix BB (pipeline development).
• **Hazards** - including an assessment of the likely risks to public safety, paying particular attention to potential geochemical and bushfire risks, and storage, handling, transport and use of any dangerous goods, in accordance with *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*;	Chapter 18 and Appendices R and E, geochemical risks addressed in Chapter 9 and Appendices D, F,J & K (mine development). Chapter 31 (pipeline development).
• **Visual** – including an assessment of:	
– the likely visual impacts of the development on private land in the vicinity of the development and key vantage points in the public domain, paying particular attention to any temporary and permanent modification of the landscape (eg overburden dumps, bunds, tailings facilities), and	Chapter 19 and Appendix S (mine development). Chapter 32 (pipeline development).

Table 1.1 McPhillamys Gold Project (SSD 9505) - EARs and where they have been addressed

Requirement	Location in EIS
– - the lighting impacts of the development; and	
• **Waste Management** – including:	
– a tailings risk assessment based on the tailings composition and identification, quantification and classification of the potential waste streams likely to be generated during construction and operation, including and not limited to non-production waster, reagent materials and cyanide compounds; and	Tailings risk assessment is contained in Appendix F, Tailings management addressed in Appendix D and Section 2.9.
– - description of the measures to be implemented to store, manage, reuse, recycle and safely dispose of these materials in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014*, including and not limited to operational water by-products, adequate spill detection and clean up systems, suitable locations for disposal or reuse of spoil generated during construction;	Management of waste rock Section 2.7. Management of non -production waste: Section 21.2 and 21.3 (mine development) and Chapter 34 (pipeline development).
• **Closure, Rehabilitation and Final Landform** – including a Rehabilitation and Landscape Management Strategy providing: – a detailed overview of the final land-use and closure criteria for the development, including both the mine site and raw water pipeline; and – - identification and discussion of opportunities to improve rehabilitation and environmental outcomes for existing disturbed areas within the project site; and	Chapter 22, and the Mine Development Rehabilitation and Landscape Management Strategy found in Appendix U. Rehabilitation of the pipeline is discussed in Chapter 35. Section 22.4 (final land use) Section 22.7 (completion criteria) The project is a greenfield development. The majority of areas within the mine project area that will not be disturbed by the mine development will continue to be used for agricultural purposes.
• **Socio-Economic** – including an assessment of:	
– an assessment of the social impacts of the project, prepared in accordance with the *Social Impact Assessment Guideline for State Significant Mining, Petroleum Production and Extractive Industry Development* (2017),including the likely impacts of the development on the local community, cumulative impacts (considering other mining developments in the locality), and consideration of workforce accommodation;	Chapter 20 and Appendix T (mine development). Chapter 33 and Appendix T (pipeline development).
– an assessment of the likely economic impacts of the development, paying particular attention to: ▪ the significance of the resource; ▪ economic benefits of the project for the State and the region; ▪ demand for the provision of local infrastructure and services; ▪ consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services.	Chapter 39 (Project justification) Chapter 36 (Economics) Section 20.5.1 (mine development) and Section 33.4 (pipeline development). Section 20.6
Consultation	
During the preparation of the EIS, you should consult with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups, Registered Aboriginal Parties (RAPs) affected landowners, and holders of existing mining and exploration authorities intersected by the proposed pipeline corridor. You must also establish a Community Consultative Committee for the project in accordance with the *Community Consultative Committee Guidelines for State Significant Projects* and consult with the committee during the preparation of the EIS. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	The consultation carried out for the purposes of the SIA is described in Section 20.3. The broader consultation conducted for the EIS is described in Chapter 4.

On 9 April 2019, LFB Resources NL referred a proposed action to the Commonwealth Minister for the Environment (Commonwealth Minister) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This referral (EPBC Act referral 2019/8421) only related to the mine development: the referral did not include the pipeline development. On 28 May 2019, a delegate of the Commonwealth Minister determined under section 75 of the EPBC Act that the proposed action is a controlled action. As such, the proposed action will also need to be assessed and approved under the EPBC Act.

For the purposes of the EPBC Act, the proposed action will be assessed under the assessment bilateral agreement between the Commonwealth Government and NSW Government.

On 30 May 2019, the Secretary of DPIE issued supplementary EARs, being the Commonwealth Department of Environment and Energy assessment requirements. These supplementary EARs, and where they are addressed in this EIS, are included in Appendix B.

The EIS has been prepared with input from several technical specialists. The EIS study team is described in Appendix E.

1.5 The applicant

As described in Section 1.1, LFB Resources NL is a 100% owned subsidiary of Regis Resources Ltd. Regis is a publicly listed Perth based gold production and exploration company trading on the Australian Stock Exchange (ASX:RRL). The addresses for Regis in WA (head office) and NSW (McPhillamys project office) are:

- Head Office: Level 2, 516 Hay Street, Subiaco WA 6008
- NSW Office: 57 Adelaide Street, Blayney NSW 2799

Regis is an Australian gold miner with a proven record of developing successful gold mining operations and is one of the top five Australian gold companies by market capitalisation and production. The company owns and operates the Duketon Project, comprising three gold mines in the North Eastern Goldfields in Western Australia, with gold production of approximately 360,000 oz/annum.

Regis has established a local office in the township of Blayney and is an active member of the local community. Regis is a member of the Orange Business Chamber, and since 2013 has given over $40,000 in support to local charities, schools, health, sporting and other local groups, including:

- Blayney Agricultural and Pastoral Association Inc;
- Lifeline Central West;
- Rotary Club of Blayney;
- Kings Plains Rural Fire Brigade;
- Blayney High School;
- Blayney Bears Senior Rugby;
- Blayney Junior Netball Association;

- Blayney Junior Soccer Club;
- Blayney Junior Rugby League;
- Blayney Golf Club;
- Newbridge Progress Association;
- Blayney District Netball Association;
- Beyond Blue; and
- Asthma Foundation.

1.6 Need for the project

The project involves a mining operation that will, consistent with the objects of the *Mining Act 1992*, extract a State-owned resource for the benefit of the State of NSW and will provide an estimated $79.9 million in royalties over the life of the mine.

The final product of the mine will be gold ore in the form of unrefined gold bars. Gold is used[2]:

- in jewellery, which accounts for approximately 51% of its global annual usage;
- as an investment instrument for governments, central banks and private investments, such as gold bars, gold backed exchange traded funds and central bank reserves, (accounting for around 40% of its global annual usage);
- in the electronics industry, due to its high conductivity and corrosion resistance, accounting for around 7% of its global annual usage;
- in medical and dentistry applications, as gold alloys are strong, resistant to tarnishing and easy to work (approximately 1%); and
- global backed exchange traded funds (about 1%).

According to the Australian Government's *National Resources Statement* (Office of the Chief Economist February 2019), world gold demand is forecast to rise by 16 percent to 2030, from 148,620 thousand ounces in 2018 to 172,906 thousand ounces in 2030.

In the shorter term, demand is forecast to increase over the next two years at an average annual rate of 3.7 per cent in 2019 and 2020, reaching a peak of 4,728 tonnes in 2020 (Office of the Chief Economist June 2019).

Growth is expected to be largely driven by central banks' gold buying due to the need to diversify central banks reserves, with a forecast increase of 4.3 per cent a year in 2019 and 2020 (Office of the Chief Economist June 2019). The growth is also expected to be largely driven by higher jewellery consumption from China and India as well as rising industrial demand, with gold continuing to be central to innovations in electronics. Whilst demand for gold remains high, Australia's export of gold is expected to decline throughout the 2020s as several mines

[2] Office of the Chief Economist, Resources and Energy Quarterly, June 2019

reach life end. On a global scale, gold supply is also forecast to decline from around 2020, due to a lack of new gold mining projects in the investment pipeline (Office of the Chief Economist March 2018).

At a local level, the *Central West and Orana Regional Plan 2036* (DPE 2017a) highlights the important role the mineral resources sector plays in underpinning many local economics in the region, noting that mining represented the largest contributor to gross regional product at $2,508 million in 2011. Priorities of the regional plan include continuing to grow and support the mining sector in the Blayney and Cabonne local government areas.

Further discussion on the demand for gold and the strategic alignment of the project with the *Central West and Orana Regional Plan 2036* (DPE 2017a) is provided in Part G (Justification) of this EIS.

The project will also deliver socio-economic benefits to the local community. A substantial number of long-term jobs (an average of approximately 260 full time equivalent positions throughout the mine life) will be created, the majority of which will be filled by persons residing in the local area. The project will add an additional $67 million in annual direct and indirect household income to the regional economies of Blayney, Bathurst, Orange and Cabonne LGAs (Gillespie Economics 2019). Greater local expenditure on goods and services will provide economic stimulus to the Blayney LGA. Investments in community facilities will also occur through a Voluntary Planning Agreement, or similar mechanism, to be established between Blayney Shire Council and Regis.

1.7 EIS structure

This EIS comprises ten volumes.

The main EIS (Volume 1), is structured as follows:

Part A – The project introduces the project, describes the background to the project, and outlines the purpose and structure of the EIS. Specifically, Chapter 1 of Part A lists the EARs and identifies where each matter is addressed within the EIS (refer Table 1.1). Part A also provides a detailed description of the project (Chapter 2).

Part B – Legislation context and stakeholder engagement outlines the regulatory framework relevant to the project (Chapter 3) and describes the stakeholder engagement completed, discusses the issues raised throughout this engagement, and how the issues have been addressed in the EIS.

Part C – Existing environment and project evolution provides information about the existing natural environmental setting and land use. It also details the evolution of the project and the alternatives that were considered for both the mine and pipeline developments.

Part D – Impact assessment: mine development assesses the potential environmental and social impacts of the mine development and the proposed management and mitigation measures to address these impacts.

Part E – Impact assessment: pipeline development assesses the potential environmental and social impacts of the pipeline development and the proposed management and mitigation measures to address these impacts.

Part F – Cumulative impacts and commitments presents a summary of the impacts of the mine development and pipeline development, so as to present an impact assessment of the McPhillamys Gold project in its entirety.

It also assesses the cumulative impacts of the project with other developments and presents a summary of the management, mitigation and monitoring commitments.

Part G - Justification and conclusion provides a detailed project justification and conclusion of the EIS.

Part H – References and Glossary details a list of all materials referenced in this EIS and defines the acronyms and terms used throughout this EIS.

1.8 Study team

The EIS has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Regis to support the SSD application for development consent under Section 4.12 of the EP&A Act for the project. Blakelys Environmental also formed part of the EIS study team and led the environmental assessment of the pipeline development component of the project. The full EIS study team is listed in Appendix E.

Chapter 2

The project

REGIS RESOURCES LTD

2 The project

2.1 Project overview

Regis is seeking State significant development consent under Division 4.1 of Part 4 of the EP&A Act to develop and operate an open cut gold mine, associated mine infrastructure and a water supply pipeline in the project application area shown in Figure 1.1 and on the land listed in Appendix A.

The mine development component of the project will produce approximately on average 200,000 ounces and up to 250,000 ounces of gold per annum over an anticipated project life of 15 years. The mine development project area and indicative mine layout; including the open cut mine, processing area, tailings storage facility (TSF), a waste rock emplacement and ancillary mining infrastructure areas, is shown in Figure 2.1.

The pipeline development will supply the majority of water required for the mine development, transferring approximately 13 ML per day (up to a maximum of 15.6 ML/day) from Centennial's Angus Place Colliery (Angus Place) and Springvale Coal Services Operations (SCSO); and Energy Australia's Mount Piper Power Station (MPPS) operations near Lithgow to the mine development during the operational phase of the project. The pipeline corridor is shown in Figure 2.2a to Figure 2.2h.

The mine development has been designed to maximise the extraction and processing of the resource in the project area within identified environmental constraints as efficiently and economically as possible, while minimising adverse impacts to the environment and community, and delivering socio-economic benefits to the local community. Similarly, the pipeline corridor has been aligned, as far as practicable, to avoid environmental constraints and minimise impacts.

The major project components are summarised in Table 2.1 Detailed descriptions of mine development components, including their construction and operation, are provided in Sections 2.4 to 2.13. A detailed description of the pipeline development is provided in Sections 2.14 to 2.16.

Table 2.1 Project overview

Aspect	Description
Project application area	The project application area is illustrated in Figure 1.1 and totals approximately 2,640 ha comprising: • 2,513 ha for the mine development project area; and • 127 ha for the pipeline corridor.
Mining lease application area	The mining lease application area is illustrated in Figure 1.2 and totals approximately 1,813 ha.
Disturbance area	Approximately 1,135 ha will be disturbed within the mine project area to accommodate the mine development, including the open cut mine, tailings storage facility (TSF), waste rock emplacement, Run-of-Mine (ROM) pad, processing plant, administration area, ablutions and workshops, water management areas, topsoil stockpiles, roads and ancillary areas. Approximately 127 ha will be temporarily disturbed for the construction of the pipeline, and to accommodate construction of pumping stations and ancillary support infrastructure associated with the operation of the pipeline.

Table 2.1 Project overview

Aspect	Description
Project duration	A project life of 15 years comprising: • Construction: around one to two years, including pre-construction activities; • Mine operating life: around 10 years of ore extraction and processing; • Rehabilitation: will progress during operations and will extend around three to four years after the end of mining and processing, after which environmental monitoring will continue until lease relinquishment in accordance with the relevant approval conditions. There will be some overlap of these phases. Figure 2.3 shows an indicative project schedule over the project life.
Mine development layout and progression	The anticipated mine layout for years 1, 2 ,4, 8, 10 is illustrated in Figures 2.4a to 2.4e. These indicative general arrangements show the expected progress of the mine development over time.
Resource	Mineral Resource Estimate (indicated + inferred) - 68.9Mt@1.04g/t gold for 2.3 million ounces Ore Reserve Estimate (probable) - 60.1Mt@1.05g/t gold for 2.0 million ounces
Annual mine extraction rate	Up to 8.5 Mtpa of ore per annum will be extracted over the project life.
Annual processing rate	Approximate processing rate of 7 Mtpa to produce on average 200,000 ounces and up to 250,000 ounces per annum of product gold.
Mining method	A single, approximately circular open cut with a diameter of approximately 1050 metres and a final depth of approximately 460 metres will be developed by conventional open cut mining encompassing drill, blast, load and haul operations.
Processing method	A carbon-in-leach (CIL) gold processing plant, comprising a ROM pad and crushing, grinding, gravity, leaching, gold recovery, tailings thickening and cyanide destruction, will be developed to the north east of the open cut mine as shown in Figure 2.1. The process flow diagram is shown in Figure 2.7.
Waste rock emplacement	A waste rock emplacement will be developed in the south-eastern portion of the mine project area up to an approximate height of 1060 m AHD to accommodate overburden material from the open cut mine. The emplacement has also been designed to encapsulate potentially acid forming material (PAF) from the open cut.
Amenity bunds	The southern portion of the waste rock emplacement (southern amenity bund) and the pit amenity bund (refer to Figure 2.1) will be constructed and rehabilitated in the early years of the mine development to provide noise and visual bunds for the remainder of operations.
Tailings storage facility	An engineered TSF will be progressively developed in the north-eastern portion of the mine project area as shown in Figures 2.1, 2.4a-e and 2.10.
General infrastructure	Construction and operation of ancillary infrastructure including: • administration buildings; • workshops and stores facilities; including associated plant parking, laydown and hardstand areas; • internal road network; • explosives magazine; and • on-site laboratory.
Site access	The mine project area will be accessed via a new intersection off the Mid-Western Highway (as shown in Figure 2.1), which will be constructed during the initial construction phase of the project. Existing property access gates from Dungeon Road and the Mid-Western Highway will also be used during the construction phase. Dungeon Road, an unsealed public road, will be used for initial access to the mine project area during construction, after which it will be closed (or realigned as per Blayney Shire Council requirements) to the public at the mine development project boundary once the new site access intersection is constructed off the highway.

Table 2.1 Project overview

Aspect	Description
Product transport	Product gold will be taken off-site via road transport.
Construction and operating hours	Construction: The first six months of construction of the mine development will generally be carried out during standard construction hours as per the *Interim Construction Noise Guideline* (ICNG)(DECC 2009): • Monday to Friday - 7:00 am to 6:00 pm • Saturday – 8:00 am to 1:00 pm • No work on Sundays or public holidays. Outside of these hours, some works will be carried as required (such as limited construction activities, environmental management such as dust control, delivery of oversized equipment, and servicing of equipment). In these circumstances, works will be undertaken in accordance with the noise criteria for outside of recommended standard hours in the ICNG. After six months, construction and mine development activities will be carried out 24 hours per day, 7 days per week. For the pipeline development, construction will be undertaken generally in accordance with the standard construction hours as per the ICNG. Operation: 24 hours per day, 7 days per week.
Workforce	Construction: estimated peak workforce during Year 1 of approximately 710 FTE employees and contractors, of which around 120 FTE will construct the pipeline development. Operation: an average workforce of around 260 FTE employees will be required during the 10 year operational mine life, peaking at approximately 320 FTEs in around years four and five of the project.
Water management	The mine development is proposed to be a nil discharge site. The water management system will divert clean water around the mine site and control the volume of water from disturbed areas by maximising its reuse on site. The water management system will comprise clean water management facilities including piped diversions, water management facilities for operational water (including the raw water storage) and development and construction water management facilities.
Water supply	A pipeline approximately 90 km in length will transfer water from Centennial's Angus Place and SCSO; and Energy Australia's MPPS operations near Lithgow to the mine site. The pipeline will deliver approximately 13 ML per day (up to a maximum of 15.6 ML per day) to the mine.
Electricity supply	The mine development will have an electricity requirement of 26 megawatts (MW) to 28 MW. The project is currently exploring two separate options for the mine developments primary power supply. The first option is the duplication of the existing 66 kV line from Bathurst. The second option under assessment is to supply the site from the Transgrid 132 kV system Line 948 which passes between Bathurst and Orange approximately 14 kilometres to north of the processing plant. Separate approval under Part 5 of the EP&A Act will be sought to construct either option. Part 5 approval will also be sought for the electricity supply for the pipeline development.
Rehabilitation	Rehabilitation will occur progressively throughout the project life. At the end of mining and processing, all infrastructure will be removed from the mine project area, and all disturbed areas will be rehabilitated to integrate with natural landforms as far as practicable. The conceptual final landform is illustrated in Figure 2.14. The pipeline corridor will be rehabilitated progressively as construction proceeds with disturbed areas being reinstated rapidly as work proceeds along the pipeline corridor. At the end of the project life, subject to the necessary approvals, there may be the opportunity for the pipeline infrastructure to continue to supply water to the region for future public benefit. Following the end of water transfer for the mine development, it is expected that the pipeline will remain in the ground. If after a reasonable time period, no additional users for the pipeline are identified, above ground components will be removed.

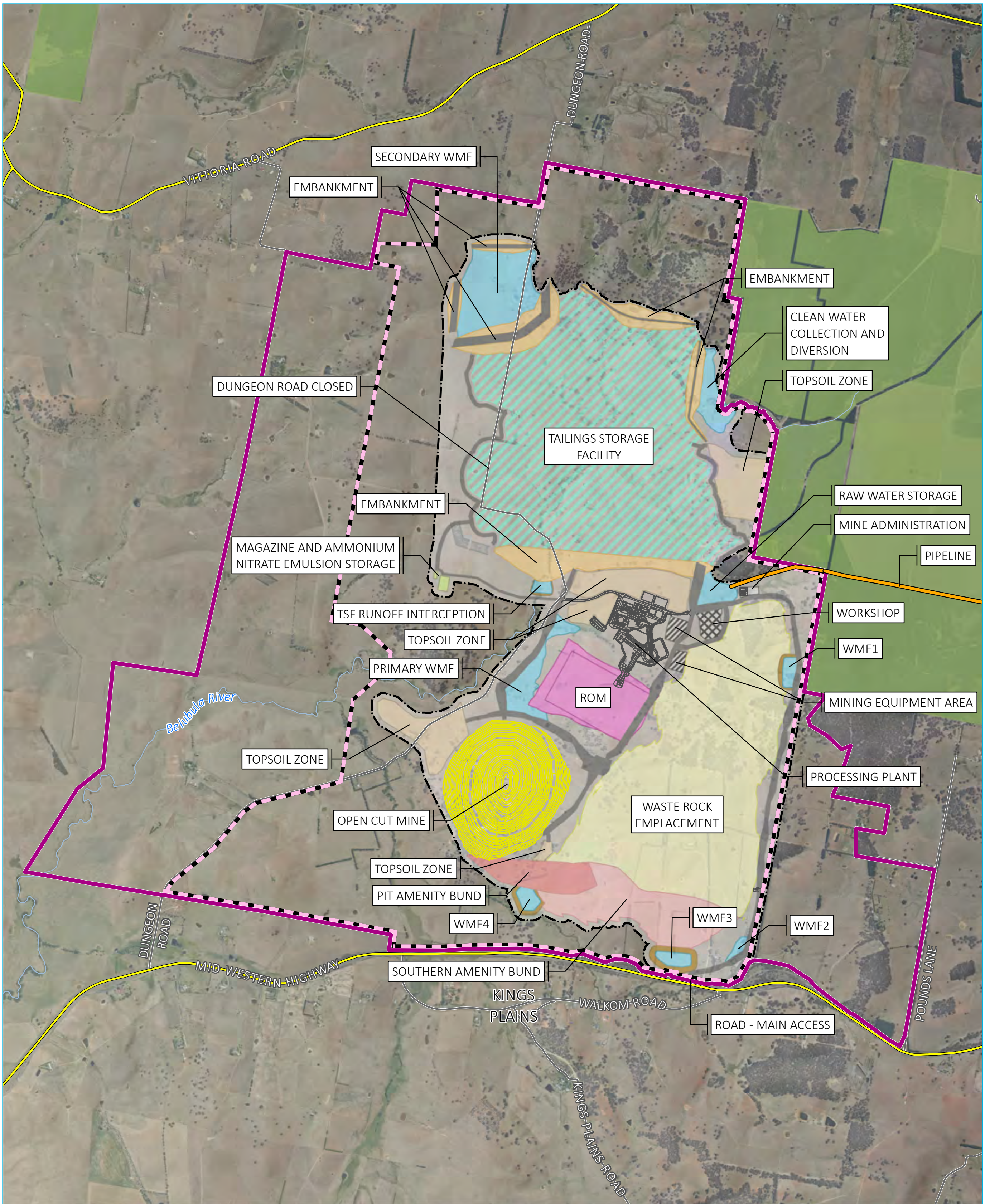
2.2 Project planning

Detailed geological, engineering, environmental and other technical investigations have shaped the project to arrive at the design described in this chapter. A series of exploration programs to target and define the gold mineralisation and metallurgical characterisation of the McPhillamys gold deposit commenced in 2006. Baseline environmental investigations for the project commenced in 2013, including ecology, heritage and soil investigations and groundwater, surface water, soil, noise, air quality and meteorological monitoring.

Numerous project design options have been examined, including tailings dam design and location, waste rock emplacement scheduling and location, processing method, site layout, water supply options and pipeline alignment. These have been optimised against environmental, technical and financial criteria, and the outcomes of the baseline investigations mentioned above. During the project development process, if an alternative option provided a significantly improved outcome, the project was redesigned. The primary alternatives considered for various aspects of the project are discussed in detail in Chapter 6.

The development of the pipeline corridor route has been guided by an avoidance policy for sensitive land uses and environmental impacts, including reducing the number of impacted landholders and avoiding/minimising potential impacts on threatened biodiversity.

Government authorities, the local community and interest groups have been consulted throughout the project planning and development phase. This consultation, combined with the results of the baseline investigations, have allowed for environmental sensitivities and other constraints to be identified early in the planning process. These constraints have been a fundamental consideration in designing the project. Further discussion on the extensive consultation conducted for the project, the issues raised by stakeholders during this consultation, and how these issues have been addressed in the project design, is provided in Chapter 4.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); DFSI (2017); GA (2011)

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KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Project general arrangement

- Plant layout
- Road
- Water management facility (WMF)
- Sediment basin structure

Existing environment

- Main road
- Local road
- Belubula River
- Vittoria State Forest

Mine development general arrangement

McPhillamys Gold Project
Environmental impact statement
Figure 2.1

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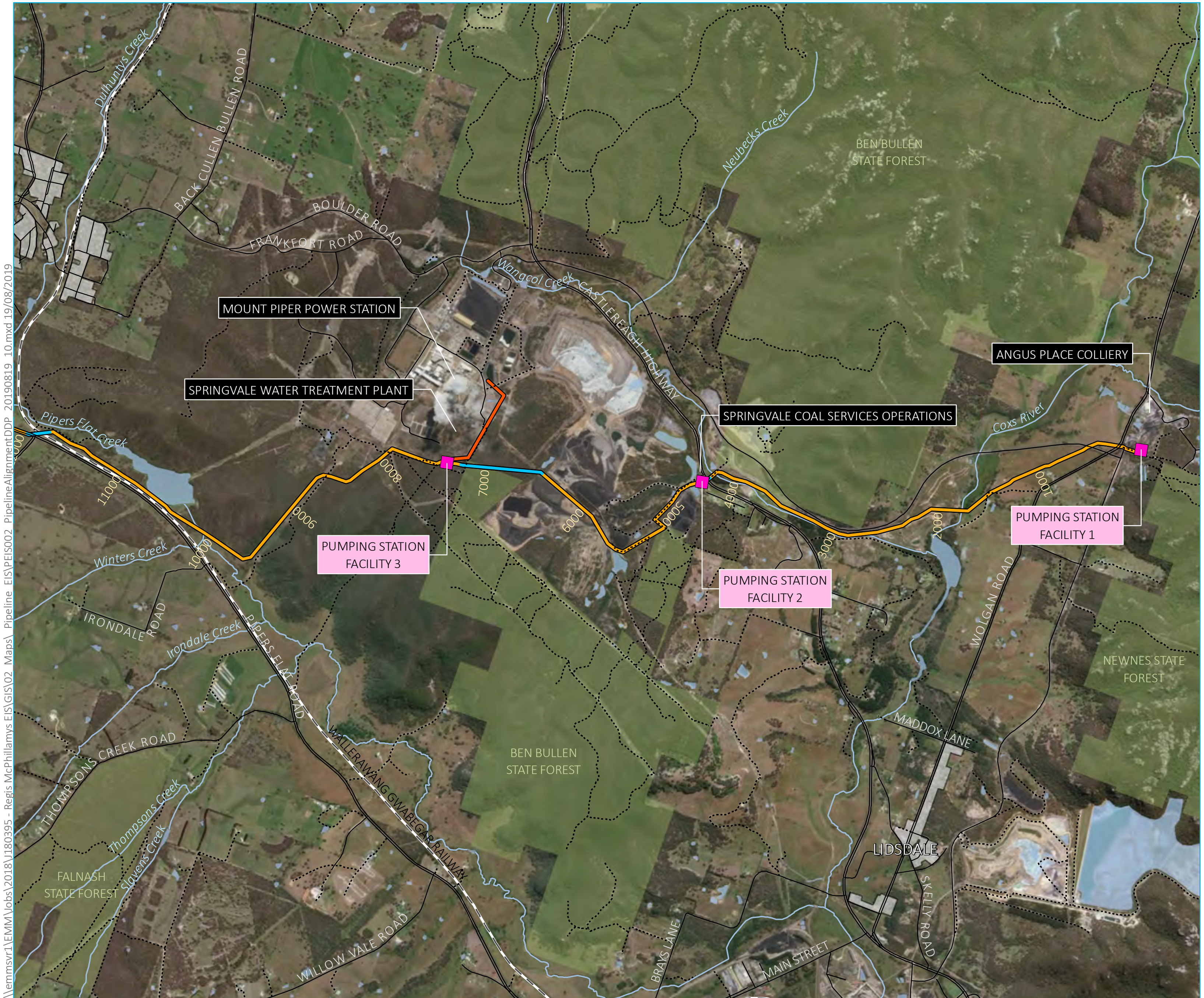

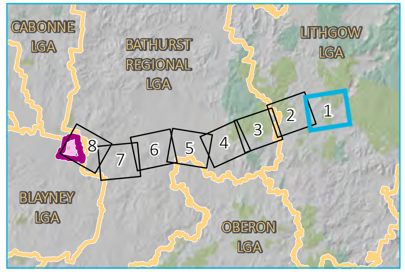

KEY

- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Built up area
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor - underbore section
- Pipeline corridor (Blowdown Pond)

Pipeline development overview

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 NSW Lambert

N

McPhillamys Gold Project
Environmental impact statement
Figure 2.2a

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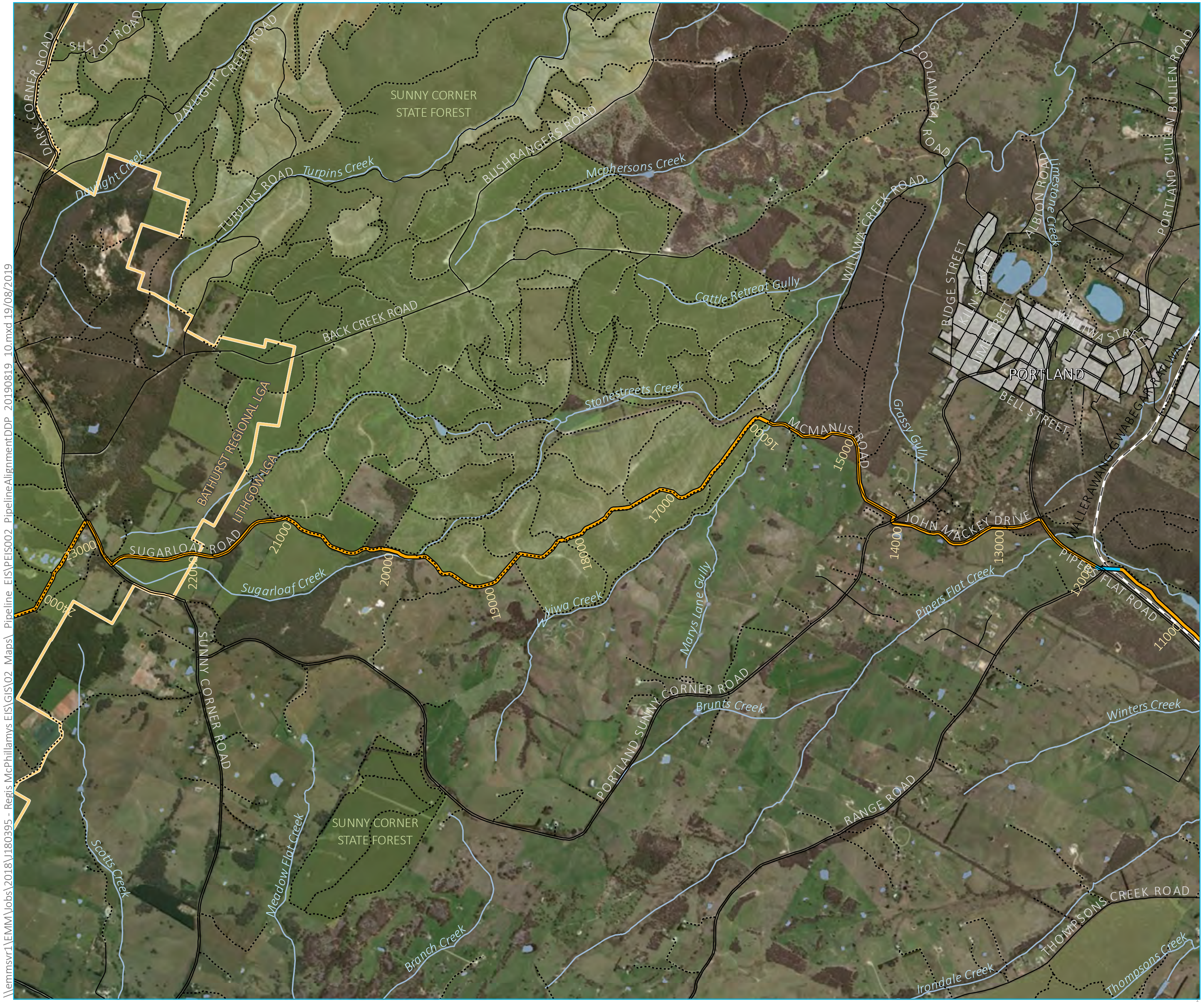

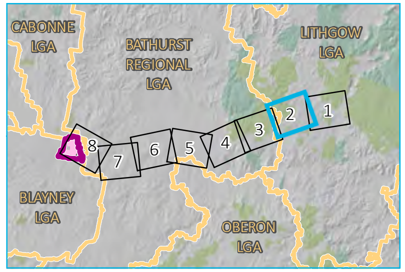

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

KEY

- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Built up area
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Pipeline corridor - underbore section

Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2b

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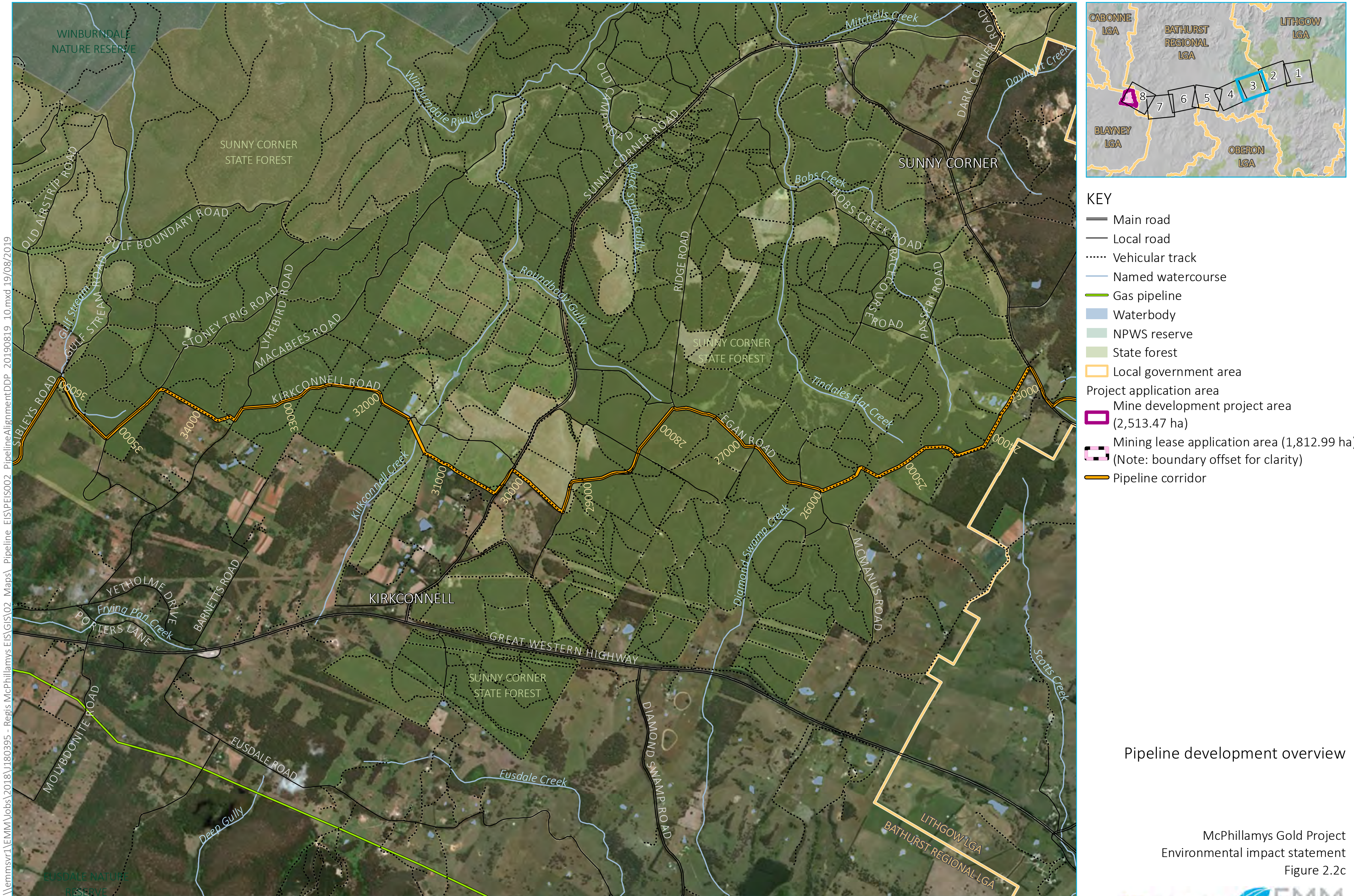

KEY
- Main road
- Local road
- Vehicular track
- Named watercourse
- Gas pipeline
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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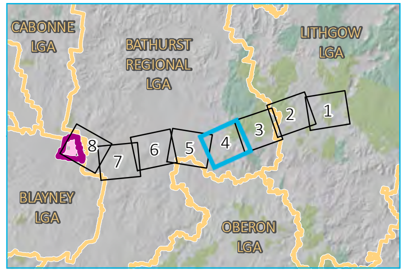
Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2c



KEY

- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Gas pipeline
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pipeline corridor - existing gas pipeline crossing
- Pipeline corridor
- Pipeline corridor - underbore section

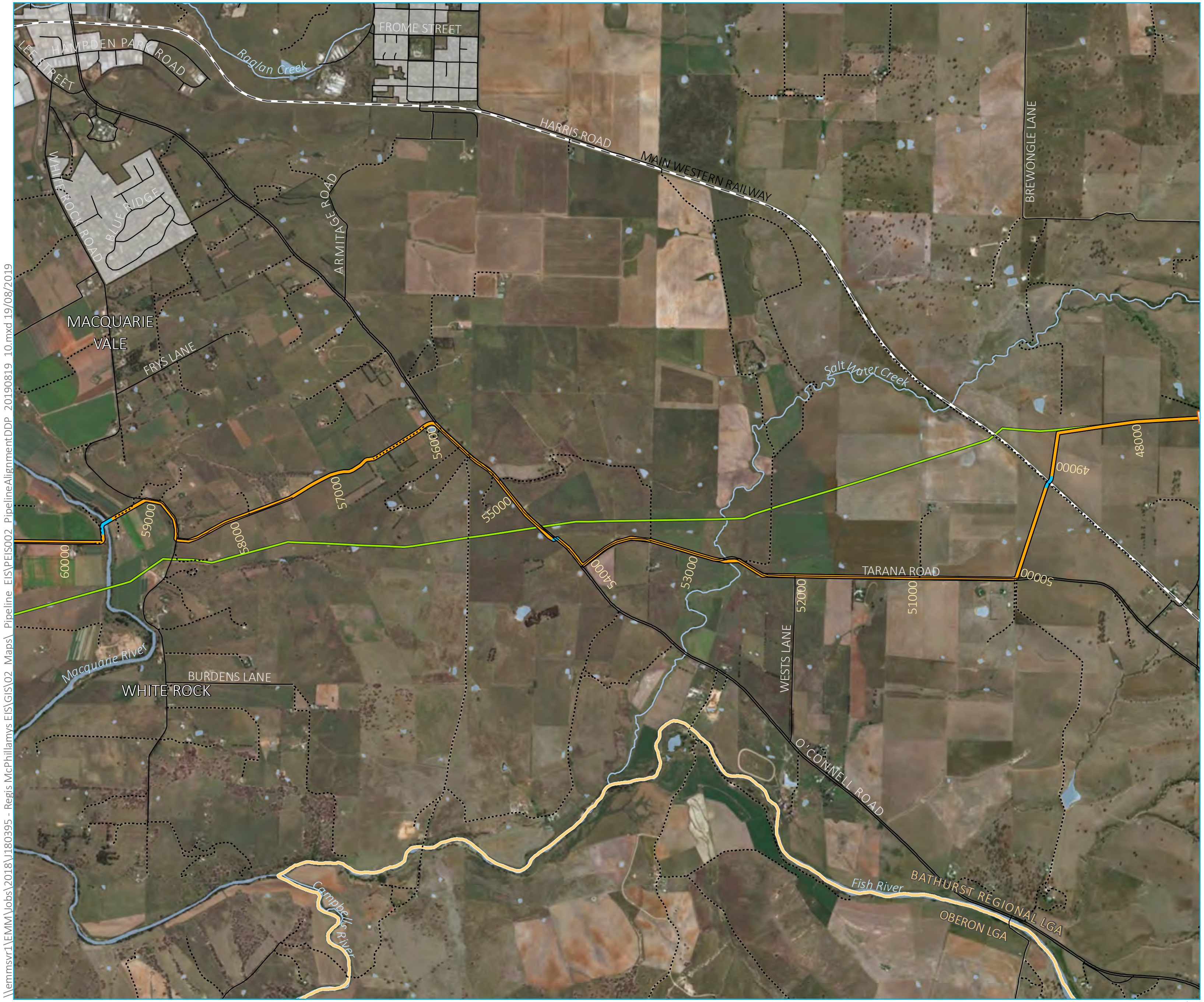
Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

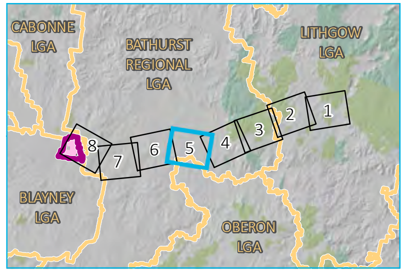
0 1 2 km

GDA 1994 NSW Lambert

Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2d





KEY

- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Gas pipeline
- Built up area
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor - existing gas pipeline crossing
- Pipeline corridor
- Pipeline corridor - underbore section

Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2e

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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GDA 1994 NSW Lambert
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REGIS RESOURCES LTD
EMM creating opportunities

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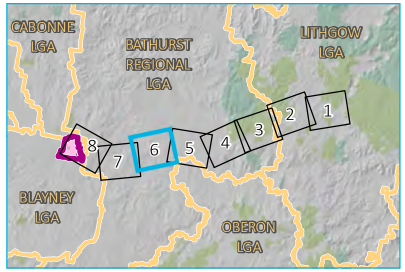

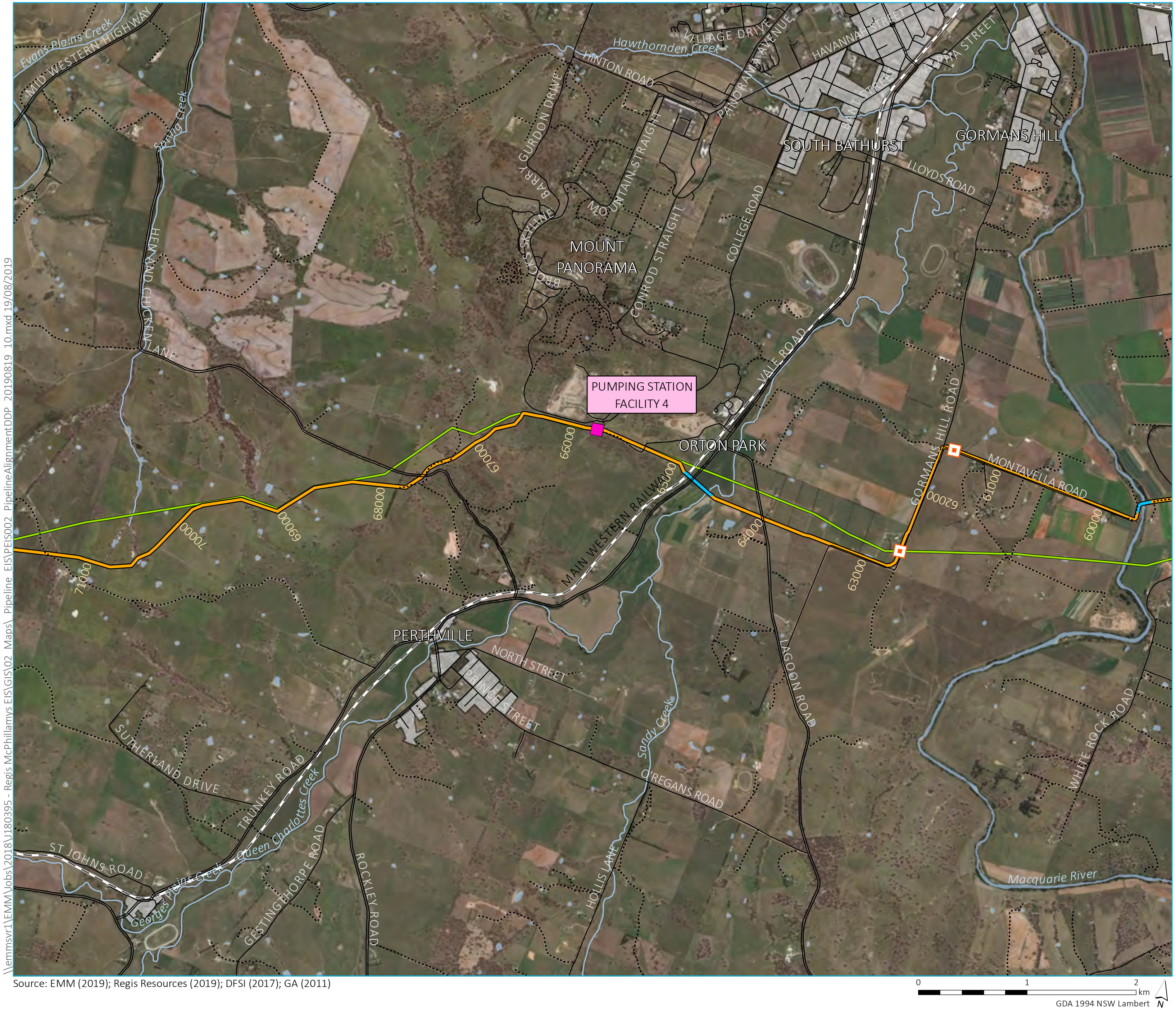

KEY

- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Gas pipeline
- Built up area
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor - existing gas pipeline crossing
- Pumping station facility
- Pipeline corridor
- Pipeline corridor - underbore section

Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2f

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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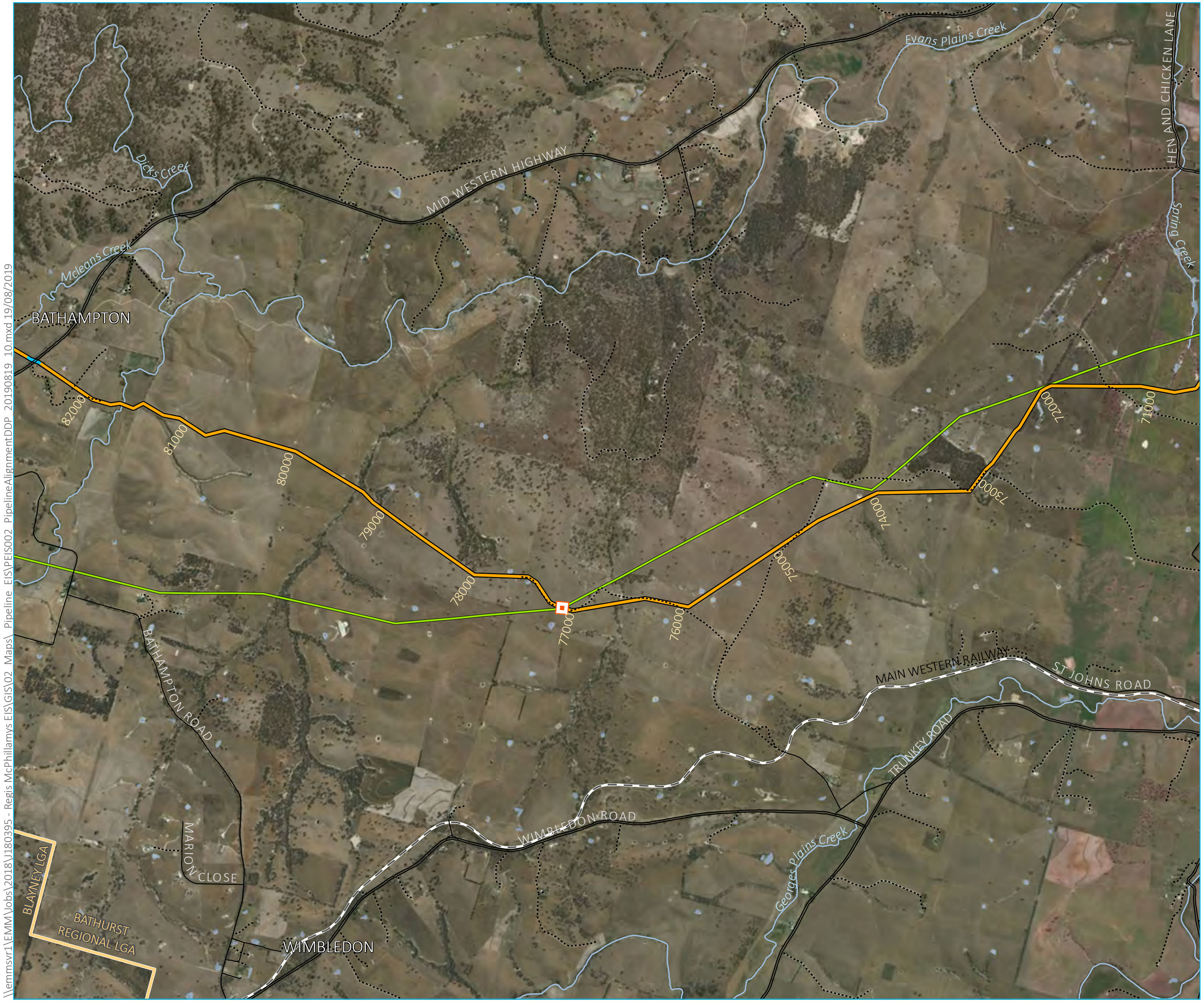


Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 NSW Lambert

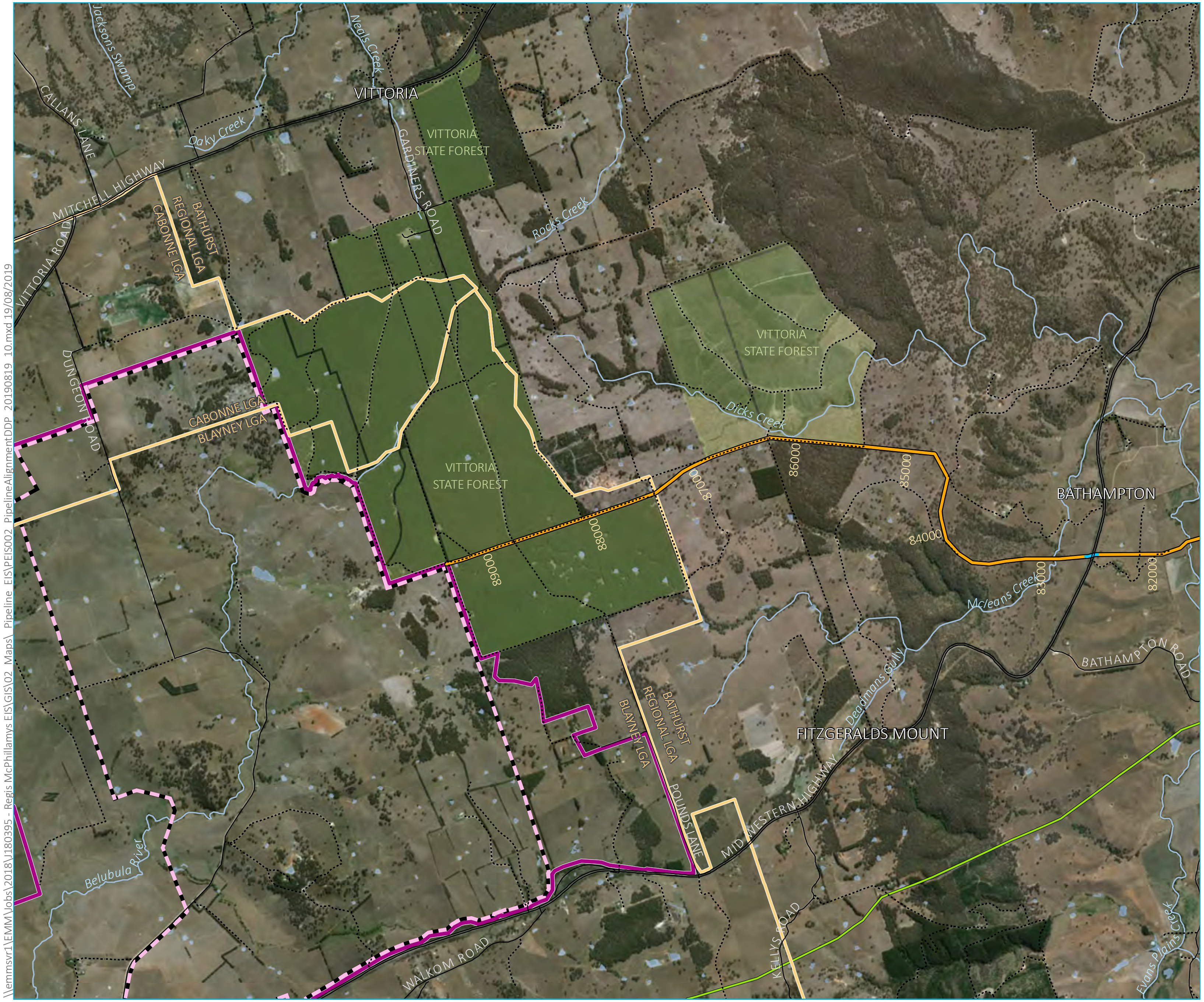
KEY
- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Gas pipeline
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor - existing gas pipeline crossing
- Pipeline corridor
- Pipeline corridor - underbore section

Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2g

\\emmsvr1\EMM\Jobs\2018\J180395 - Regis McPhillamys EIS\GIS\02_Maps_Pipeline_EIS\PEIS002_PipelineAlignmentDDP_20190819_10.mxd 19/08/2019



KEY

- Main road
- Local road
- Vehicular track
- Named watercourse
- Gas pipeline
- Waterbody
- NPWS reserve
- State forest
- Local government area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Pipeline corridor - underbore section

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 NSW Lambert

\\emmsvr1\EMM\Jobs\2018\J180395 - Regis McPhillamys EIS\GIS\02_Maps_Pipeline_EIS\PEIS002_PipelineAlignmentDDP_20190819_10.mxd 19/08/2019

Pipeline development overview

McPhillamys Gold Project
Environmental impact statement
Figure 2.2h

2.3 Indicative project schedule

The project will have a total life of 15 years, including construction, mining and processing activities and rehabilitation and decommissioning. An indicative schedule for the project is presented in Figure 2.3. This EIS refers to project years rather than calendar years, with Year 1 being the first year of construction and mine development activities. As illustrated, there will be an overlap between the construction and operational phases. There will also be an overlap between processing and the decommissioning phase.

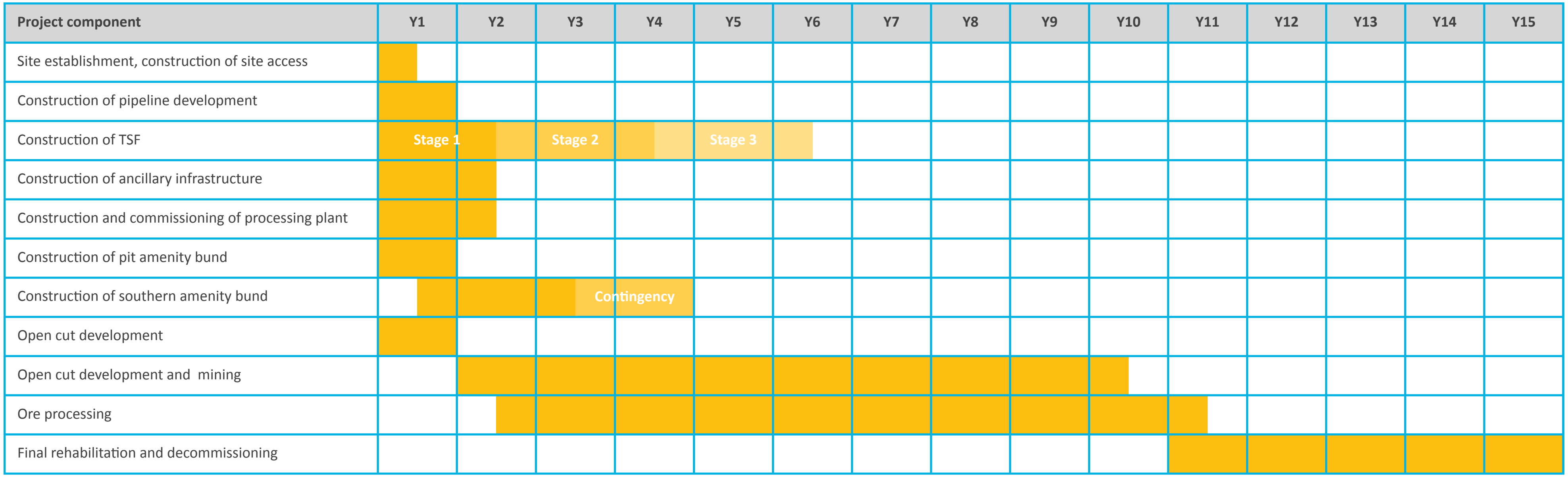
Over the life of the mine development, this indicative schedule may vary from that shown in Figure 2.3 to account for detailed mine design, mine economics, geological conditions, market conditions or relevant approval conditions.

2.4 Mine development general layout and progression

Indicative general layouts of the mine development over the project life are illustrated for Years 1, 2, 4, 8 and 10 in Figures 2.4a to 2.4e. As per the project schedule, this indicative mine development sequencing may also vary to account for detailed mine design, mine economics, geological conditions, market conditions or relevant approval conditions.

The direct disturbance footprint of the mine development is shown in Figure 2.1. In addition to this nominated footprint, other minor disturbance associated with ancillary works for the mine development may be required to occur within the project area boundary. For example, minor disturbances associated with pipelines and associated access tracks, power and telecommunication supply infrastructure, fences, sediment control structures and installation of monitoring equipment and associated access. Any ancillary disturbance outside the nominated disturbance footprint in this EIS will be appropriately managed through a permit to disturbance process.

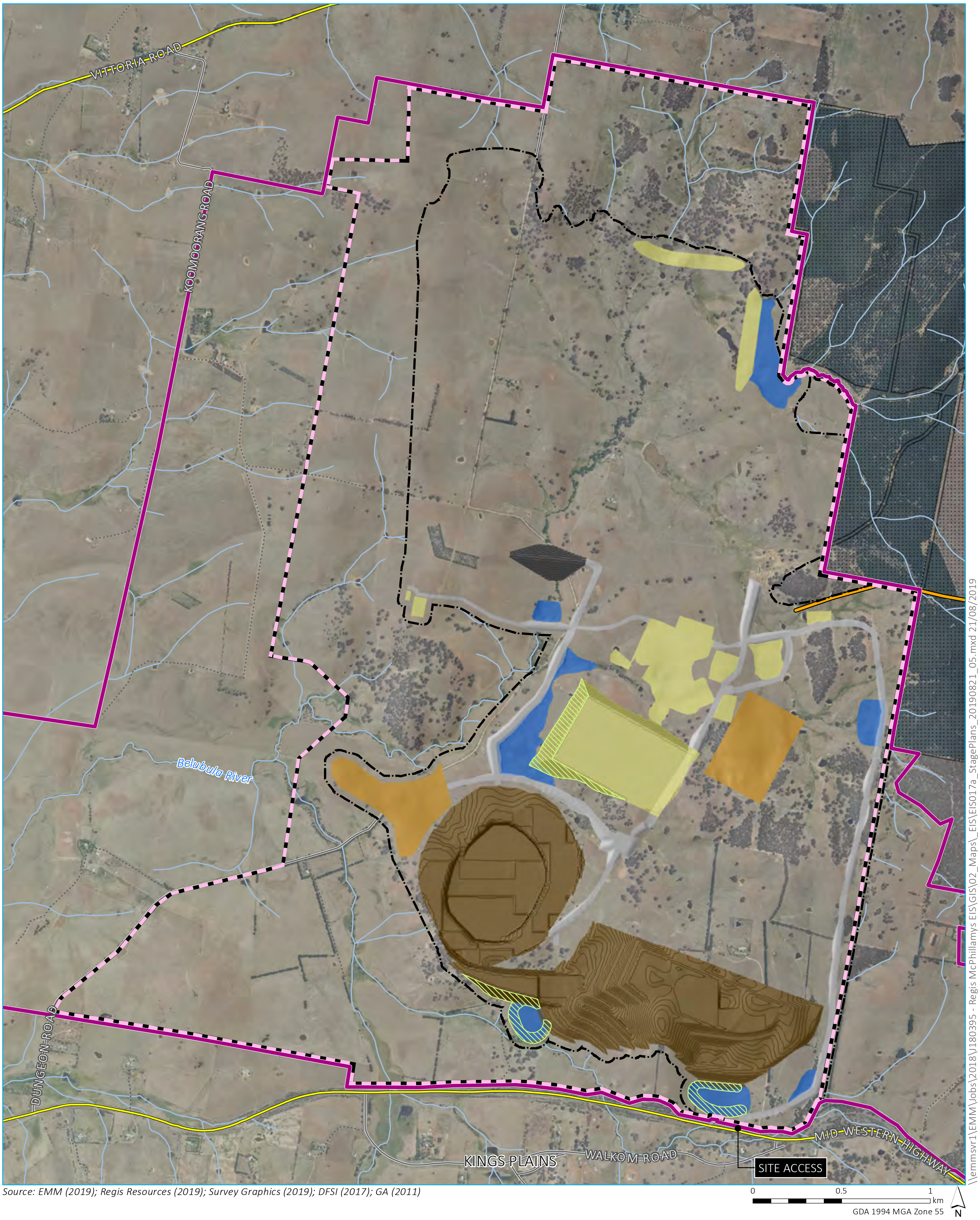
Notwithstanding, environmental features identified in technical assessments outside of the disturbance footprint will be clearly marked as avoidance zones to avoid environmental impacts on these features.



Indicative project schedule

McPhillamys Gold Project
Environmental impact statement

Figure 2.3



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha)
- Disturbance footprint
- Pipeline corridor
- Mine plan contour (2.5 m)

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Completed works

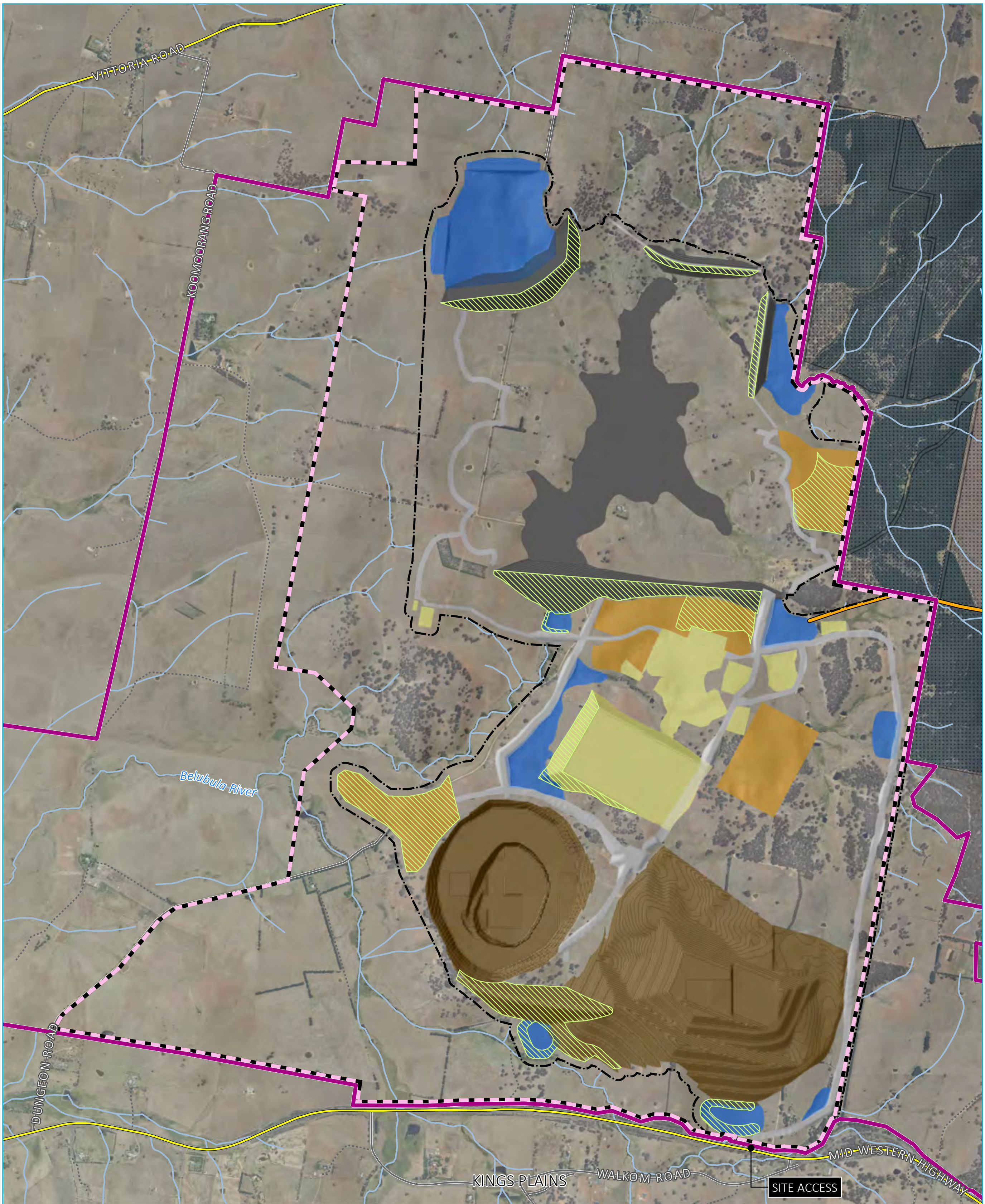
- Mine infrastructure area (under construction)
- Mining operations (open cut & waste rock emplacement)
- Road
- Tailings storage facility construction
- Topsoil zone
- Water management area

Mine rehabilitation

- 70% cover - hydromulched/grass

Mine development general arrangement - Year 1

McPhillamys Gold Project
Environmental impact statement
Figure 2.4a



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km
GDA 1994 MGA Zone 55
N

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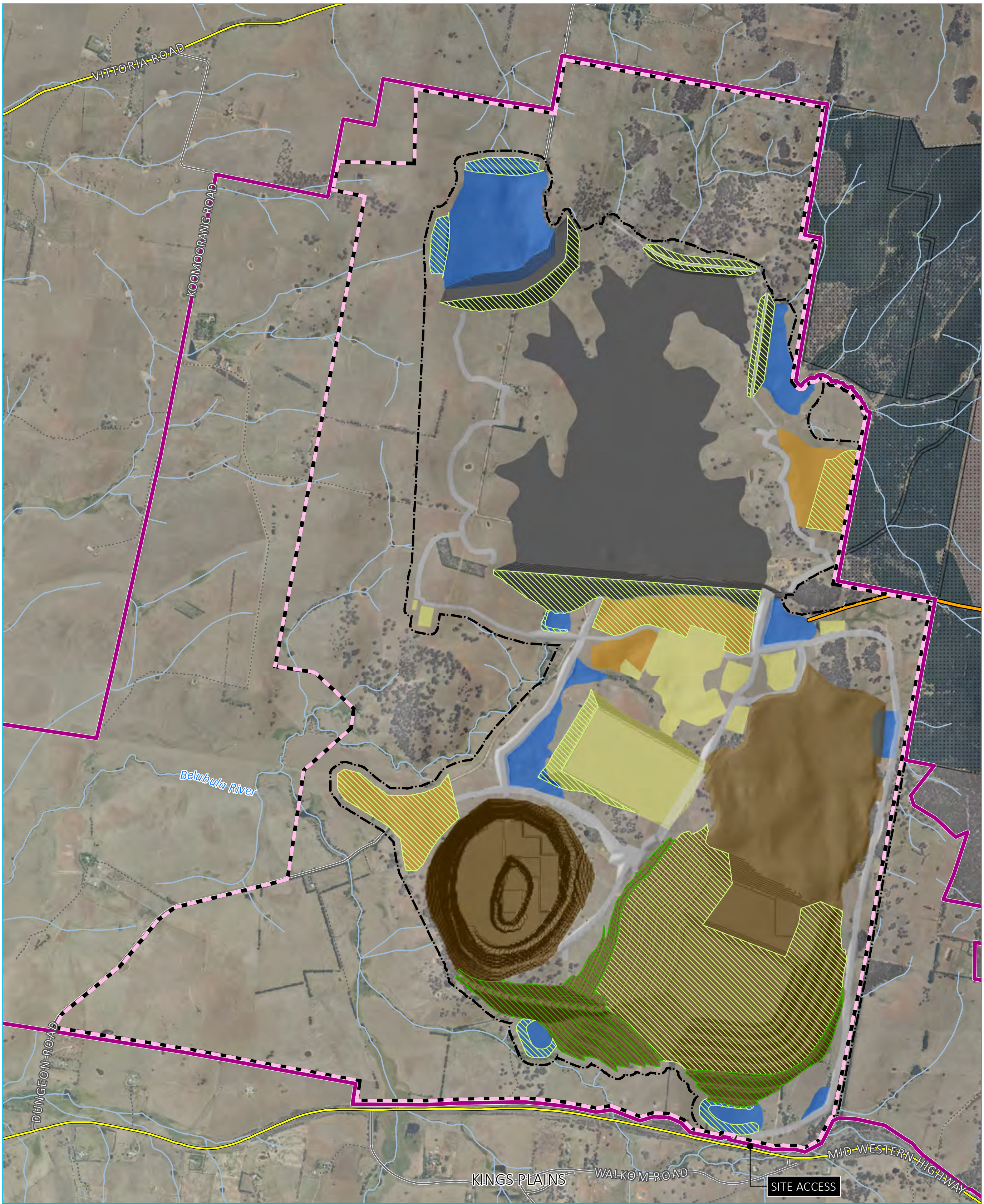
KEY

Mine development project area (2,513.47 ha)
Mining lease application area (1,812.99 ha)
Disturbance footprint
Pipeline corridor
Mine plan contour (2.5 m)
Existing environment
Main road
Local road
Vehicular track
Watercourse/drainage line
Vittoria State Forest
Completed works
Mine infrastructure area
Mining operations (open cut & waste rock emplacement)
Road
Tailings storage facility
Topsoil zone
Water management area
Mine rehabilitation
70% cover - hydromulched/grass

Mine development general arrangement - Year 2

McPhillamys Gold Project
Environmental impact statement
Figure 2.4b

REGIS RESOURCES LTD
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); ;DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

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KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha)
- Disturbance footprint
- Pipeline corridor
- Mine plan contour (2.5 m)

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Completed works

- Mine infrastructure area
- Mining operations (open cut & waste rock emplacement)
- Road
- Tailings storage facility
- Topsoil zone
- Water management area

Mine rehabilitation

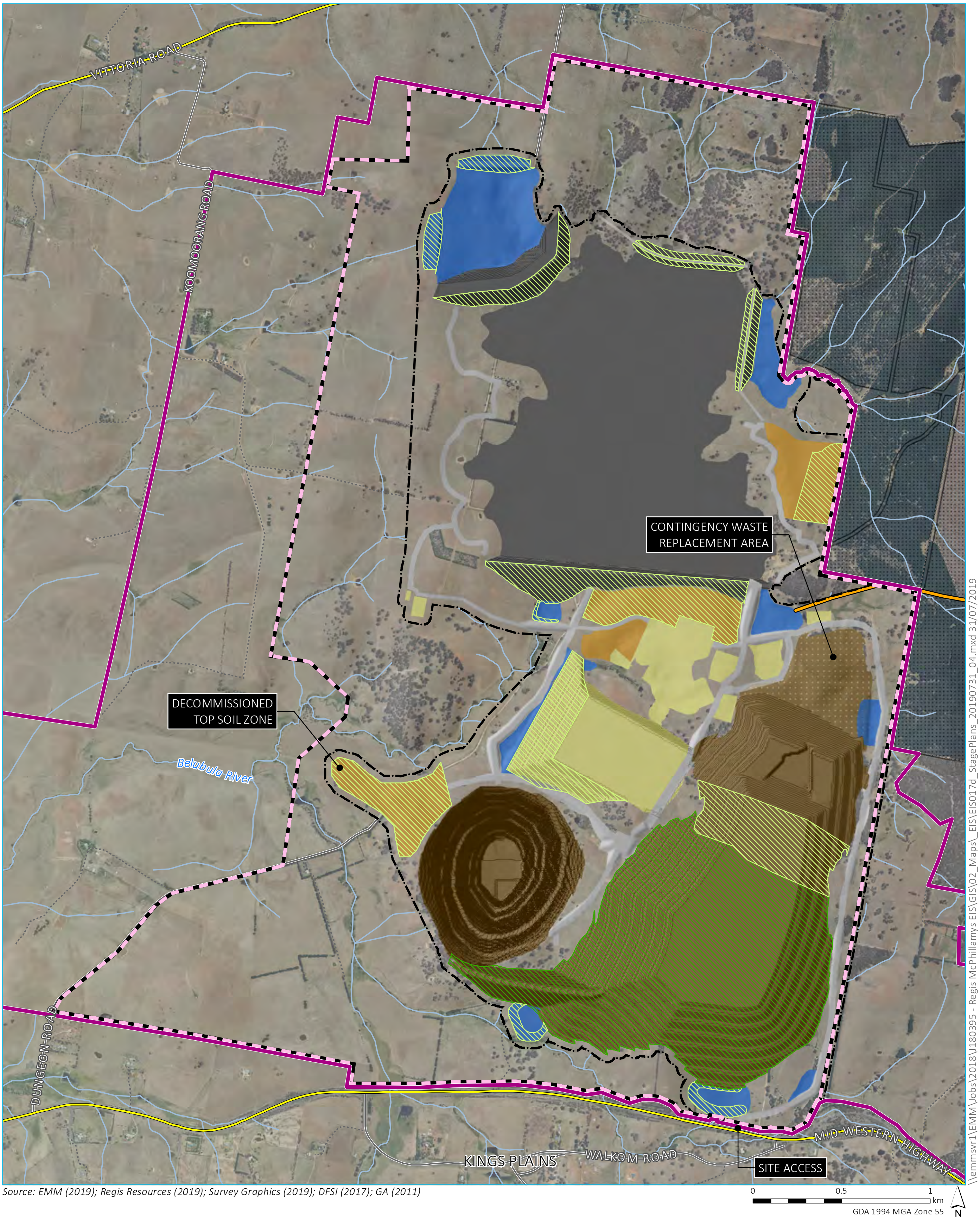
- 70% cover - hydromulched/grass
- Early stages of open woodland establishment

Mine development general arrangement - Year 4

McPhillamys Gold Project
Environmental impact statement
Figure 2.4c

REGIS RESOURCES LTD

EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha)
- Disturbance footprint
- Pipeline corridor
- Mine plan contour (2.5 m)

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Completed works

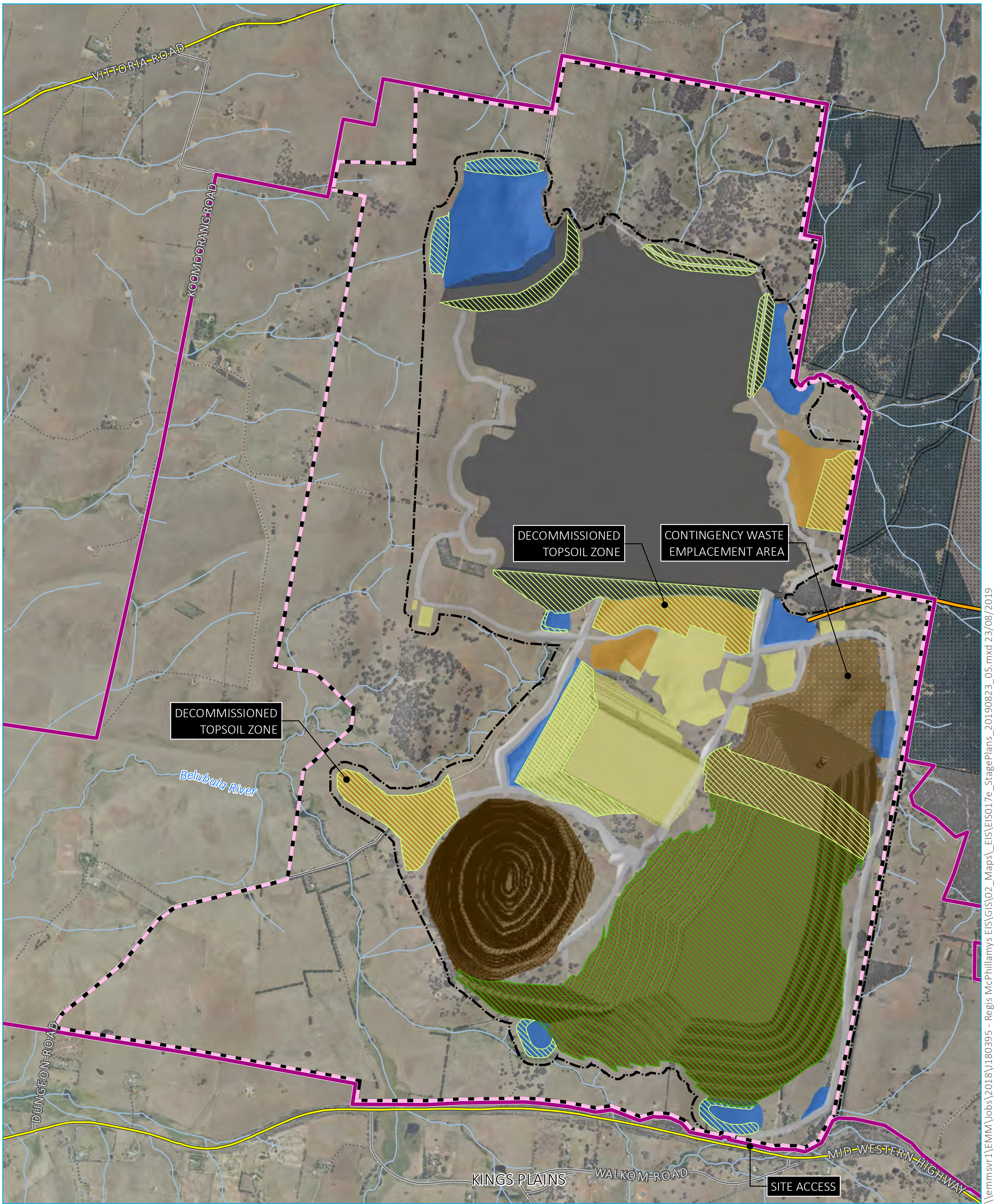
- Mine infrastructure area
- Mining operations (open cut & waste rock emplacement)
- Road
- Tailings storage facility
- Topsoil zone
- Water management area

Mine rehabilitation

- 70% cover - hydromulched/grass
- Early stages of open woodland establishment

Mine development general arrangement - Year 8

McPhillamys Gold Project
Environmental impact statement
Figure 2.4d



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha)
- Disturbance footprint
- Pipeline corridor
- Mine plan contour (2.5 m)

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Completed works

- Mine infrastructure area
- Mining operations (open cut & waste rock emplacement)
- Road
- Tailings storage facility
- Topsoil stockpile
- Water management area

Mine rehabilitation

- 70% cover - hydromulched/grass
- Early stages of open woodland establishment

Mine development general arrangement - Year 10

McPhillamys Gold Project
Environmental impact statement
Figure 2.4e

REGIS RESOURCES LTD

EMM creating opportunities

2.5 Mine development - construction phase

The construction phase associated with the establishment of the mine development is detailed below.

2.5.1 Overview

The construction phase of the mine development will include:

- site establishment, including installation of erosion and sediment controls, vegetation clearing, topsoil/subsoil stripping and stockpiling activities;
- early development of the open cut to provide material for haul roads, amenity bunds, ROM pad, TSF and water management facility embankments and the site access road;
- construction of the pit amenity bund and southern amenity bund of the waste rock emplacement;
- construction of the mine access road and intersection from the Mid-Western Highway and internal access roads;
- development of borrow pits;
- construction of the TSF and water management facilities, including bulk earthworks to construct the embankments of the TSF and water management facilities and necessary lining works;
- construction of the administration buildings, car parking, workshop facilities, equipment stores, explosives magazine and ammonium nitrate emulsion storage;
- construction and commissioning of the processing plant; and
- installation of site services including power, communication and potable water and wastewater services.

Further detail on key elements of the construction phase is provided in the sub-sections below.

2.5.2 Site establishment

Site establishment activities will include installing erosion and sediment control measures, clearing of vegetation, topsoil and subsoil stripping and stockpiling as well as establishment of construction compounds and laydown areas.

Before any works commence, areas to be cleared will be marked to prevent any damage to vegetation beyond clearing limits. Erosion and sediment controls will then be formed in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition* (Landcom 2004) (the Blue Book) and *Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries* (DECC 2008) as described in further detail in Chapter 7 (soil and land resources).

Once vegetation is cleared, topsoil will be stripped following the recommendations of the Land Capability and Soil Assessment (SSM 2019) contained in Appendix H and summarised in Chapter 7. Topsoil will be stored in stockpiles at the indicative topsoil zones shown in Figure 2.1 until required for rehabilitation activities.

Soil will generally be stripped from the direct disturbance footprint to a depth of approximately 60 cm, depending on the suitability of the soil. Soil will generally be stripped in two layers. The top 10 cm to 15 cm layer (ie the topsoil), which has a higher organic matter and nutrient content than the underlying soil, will be stripped and stockpiled separately. A further 45-50 cm of subsoil will then be stripped and stockpiled for use in rehabilitation. Further detail on soil resources in the mine project area is provided in Chapter 7.

Soil storage locations will vary over the life of the mine development, depending on the area available and planned final deposition location. Detailed topsoil and subsoil stripping and scheduling will be completed during the detailed design phase. Indicative topsoil zones are shown in Figure 2.1. It is also expected topsoil will be stored within the footprint of the waste rock emplacement and then reclaimed and used for progressive rehabilitation of the southern and pit amenity bunds.

2.5.3 Development of the open cut

Mining of waste rock will commence following initial site establishment activities. Suitable waste rock material (ie non-acid forming (NAF)) will be used for the construction of infrastructure required for the mine development, including haul roads, ROM pad, site access and internal roads, TSF and secondary water management facility (WMF) embankments, amenity bunds, hardstand areas and other water management infrastructure.

Early in the mine life suitable waste rock will be in high demand as a construction material for site earthworks. Indicative mine scheduling has been informed by the anticipated availability of suitable waste rock for construction activities.

2.5.4 Pit amenity bund and southern amenity bund

The pit amenity bund and southern amenity bunds are shown in Figure 2.1. The pit amenity bund runs from the south of the open cut, connecting to the highest point of the southern amenity bund to the east. The southern amenity bund forms the southern extent of the waste rock emplacement. Both amenity bunds have been designed to mitigate noise and visual impacts on receivers residing in Kings Plains to the south and south west of the mine development. As described in Chapter 10 (noise), the pit amenity bund was added to the project design to shield haul trucks exiting the open cut pit, thus reducing associated noise and visual impacts. The southern amenity bund will provide an effective barrier which mobile equipment can work behind as waste rock is progressively dumped in the waste rock emplacement.

The pit amenity bund and southern amenity bunds will be constructed early in the mine development following the construction of the necessary haul roads, ROM pad and water management infrastructure. The pit amenity bund is expected to be constructed in Year 1. The southern amenity bund is expected to be constructed between Year 1 and Year 4 of the mine life. This indicative schedule balances the requirement to manage early development of the open cut in relation to the demand for waste rock material to construct other site infrastructure such as the TSF embankments, the management of potentially acid forming (PAF) waste rock (refer Section 2.7), as well as the requirement to manage night time noise levels at Kings Plains to the south of the mine project area.

Detailed mine design will aim to optimise the mine scheduling and in particular the waste dumping schedule to construct the amenity bunds as soon as practicable within approved noise limits to provide noise and visual bunds for the remainder of the project life.

2.5.5 Site access and internal roads

Primary access to the mine will be via a new access from the Mid-Western Highway, to be constructed in the south-eastern corner of the mining lease application area. The new access intersection will be constructed approximately 190 m west of the Walkom Road (east) intersection and will consist of an auxiliary left turn land and a channelised right turn lane. The proposed intersection has been designed to cater for the worst-case scenario of peak background traffic and project related traffic. A concept design for the new site access is contained in the Traffic and Transport Assessment (Constructive Solutions 2019) for the mine development contained in Appendix Q.

Construction traffic will initially access the mine project area via Dungeon Road. Once the new site access is complete the Dungeon Road access will be closed; however access via locked gates will be maintained via Dungeon Road for emergency vehicles, environmental monitoring, mine inspections or in the event of an unplanned blockage of the new site access. Dungeon Road will be closed (or realigned as per Blayney Council requirements) to the public at the start of construction activities. In the event Dungeon Road is realigned, separate approval under Part 5 of the EP&A Act will be sought for realignment works.

Internal all weather graded access roads will be established where required to provide access to mine infrastructure areas including to the TSF, processing plant, open cut pit and ancillary areas. Approximate locations of the internal access roads are shown in Figure 2.1.

Further detail regarding the proposed new intersection and site access is provided in Chapter 17 Traffic and transport and Appendix Q.

2.5.6 Borrow pits

Borrow pits located within the disturbance footprint may also be required to obtain suitable gravel for construction of the access road and other internal access roads if suitable material cannot be sourced from the open cut. The development of borrow pits will generally involve:

- removal and stockpile of topsoil and subsoil;
- extraction of gravel to a depth of up to 3 m;
- stockpiling of gravel adjacent to borrow pit;
- processing in a mobile crushing/screening plant (if required); and
- transporting gravel by truck to locations within the disturbance footprint.

In the event suitable gravel for the main access road or other earthworks cannot be obtained from within the disturbance footprint, Regis will source the required material from a local quarry.

Borrow pits may also be developed to obtain sufficient clay to line the TSF (refer to the following section).

2.5.7 TSF construction

The TSF will be developed in stages to minimise the extent of disturbance and to synchronise with the progressive development of the open cut and availability of waste rock which will be used for the construction of TSF embankments. The design, staging and operation of the TSF is described in detail in Section 2.9. The indicative construction methodology of the TSF is described below.

i Preparation works

All investigation and monitoring bores currently within the footprint of the TSF will be grouted, prior to the start of construction works. Erosion and sediment control measures will be implemented to minimise sediment transport from embankment construction, storage liner and clay borrow pits. The TSF run off interception water management facility (WMF), directly downstream of the main embankment, will be constructed prior to the start of embankment works. This WMF will function as the initial sedimentation basin for the TSF construction works.

Clearing and soil stripping would be carried out within the embankment footprint area, emergency spillway and storage area.

ii Embankment construction

General sub-excavation will be carried out beneath the entire width of the embankment foundations to remove weak, compressible or over-saturated soils. The anticipated depth range of foundation sub-excavation will be 0.4 m to 1.0 m. A cut-off key will be excavated generally to a competent basement of low permeability, then back filled with clay fill. Localised grouting of seepage areas and irregular surfaces may also be required to allow placement of the clay fill.

Embankment development will involve construction of an upstream clay lined zone (above the clay filled cut-off key), internal rock fill transition zone and downstream rock fill buttress. Clay will be selectively sourced from borrow pits located within the storage area and the general surrounds of the TSF, and rock fill will be sourced predominantly from the open cut.

Controls for seepage management will also be installed during embankment construction (refer Section 2.9.7 for further detail regarding seepage management).

iii Lining

Lining of the TSF floor is proposed to consist of a suitable low permeability lining comprising:

- in drainage features such as the former Belubula River and other areas with weathered geology, a full depth storage blanket liner of clay fill with a minimum depth of 1,000 mm and a permeability of 1×10^{-9}m/s;

- in other areas and where suitable clay fill is available, the area will be conditioned by scarifying/ripping, moisture conditioning and compacting to provide a clay fill liner with a minimum depth of 300 mm and a permeability of 3.3×10^{10}m/s (less than or equivalent to 1,000 mm @ 1×10^{-9}m/s); and

- in remaining areas where insufficient suitable clay fill is available, the area will be lined with a geomembrane liner with a permeability less than or equivalent to 1,000mm @ 1×10^{-9}m/s.

2.5.8 Site infrastructure construction

Hardstand areas will be constructed in and around the processing facility. Hardstand areas will also be established to accommodate the workshop, magazine and administration buildings as well as the mining equipment area. A concrete batching plant may be accommodated onsite to facilitate these works.

The components of the processing plant such as structural elements, mechanical equipment (conveyors), electrical equipment, tanks, mills and pipework will be installed by dedicated installation teams.

Most buildings will be portable demountable structures that will be transported to the site. Where possible, modular construction will be used to minimise site work and reduce construction timeframes. A full description of the mine administration area is provided in Section 2.11.

2.5.9 Site services

During the early phases of construction existing site utilities will be used for the provision of power and communications. Generators will also be used as required.

During early construction and open cut development activities water will be used predominately for dust suppression and machinery washdown. Prior to commissioning of the pipeline, water will be derived predominately from rainfall runoff captured in accordance with Regis' harvestable rights entitlement.

Prior to the commissioning of the pipeline development before the end of Year 1, there may be a shortfall in construction and dust suppression water.

Potential shortfalls will be managed by investigating alternative water supplies, such as establishing onsite production bores or production bores on neighbouring properties nearby under agreement and turkey nest storage, or purchasing and trucking water to site, and reducing haul road dust suppression water demand by the use of dust suppression agents.

Up until the commissioning of the processing plant, water will be pumped on demand from the pipeline water supply to ensure site construction and dust suppression water demands are met and the water management facilities have adequate storage for rainfall events.

It should be noted that prior to processing commencing, pipeline water supply would be based on demand requirement.

2.5.10 Construction equipment

Equipment required for construction activities will vary throughout the construction phase, and is likely to include scrapers, backhoes, graders, hydraulic excavators, articulated trucks, rear dump trucks, mobile cranes, vibrating rollers, water carts, track dozers for topsoil stripping, front end loaders, generators, screening/batching plant, water pumps, lighting plants and light vehicles.

The mining fleet used during the development of the mine (in around Year 1 to Year 3) is anticipated to include a primary fleet of:

- 4 excavators;
- up to 17-20 primary haul trucks;
- 3 secondary haul trucks;
- 4 production drills;
- 2 ancillary drills;
- up to 3 track dozers; and
- 2 wheeled dozers.

From about month 7, when construction activities begin to also be conducted at night, this mining fleet will be restricted in size and/or in operating location during the evening and night time periods when operations are occurring in the south of the mine project area on the southern amenity bund, and until the open cut mine reaches a depth of approximately 100 m (850 m RL) to manage noise levels in Kings Plains to within the relevant limits.

Further discussion on managing noise is provided in Chapter 10.

2.5.11 Construction schedule

The first six months of construction will be carried out generally during standard construction hours as per the Interim Construction Noise Guideline (DECC 2009) (ICNG):

- Monday to Friday - 7:00 am to 6:00 pm
- Saturday – 8:00 am to 6:00 pm
- No work on Sundays or public holidays

Outside of these hours, some works will be carried as required (ie limited construction activities, environmental management such as dust control, delivery of oversized equipment, servicing of equipment). In these circumstances, works will be undertaken in accordance with the noise criteria for outside of recommended standard hours in the ICNG.

After six months, construction and mine development activities will be carried out 24 hours per day, 7 days per week.

As shown in Figure 2.3, operations will phase in progressively in the later stages of construction. Therefore, there will be some overlap between construction and operation phases.

2.6 Open cut mining operations

2.6.1 Mineral resource

The McPhillamys gold mineralisation is located within a sequence of sheared Silurian metavolcanics and volcanoclastic rocks forming part of the Eastern Lachlan Fold Belt of NSW. The shear zone has been defined over 800 m along strike with a width of 200 m and 700 m down dip. The mineralisation is bound to the west by the Sherlock Fault and is somewhat structurally constrained between a set of normal faults trending northeast-southwest produced by dextral movement along the Sherlock Fault. The mineralisation is cylinder shaped, approximately 200 m in diameter beginning near the surface and extending near vertically to depth. The grade increases with depth, with the highest grades near the base of the proposed open cut.

Regis completed a Joint Ore Reserve Committee (JORC) compliant Mineral Resource Estimate and Ore Reserve Estimate in September 2017 (Regis Resources 2017). The results of this estimation are summarised **below in Table 2.2**. A mineral resource is defined as a geological concentration of material which has a reasonable prospect of eventual economic extraction and is not constrained by likely mining limitations. An ore reserve on the other hand, refers to the component of the mineral resource that may be economically and realistically mined.

Table 2.2 McPhillamys Mineral Resource and Ore Reserve Estimate

	Tonnes (Mt)	Gold grade (g/t)	Contained gold (Oz)
Mineral Resource	68.9	1.04	2,307,000
Ore Reserve (Probable)	60.1	1.05	2,034,000

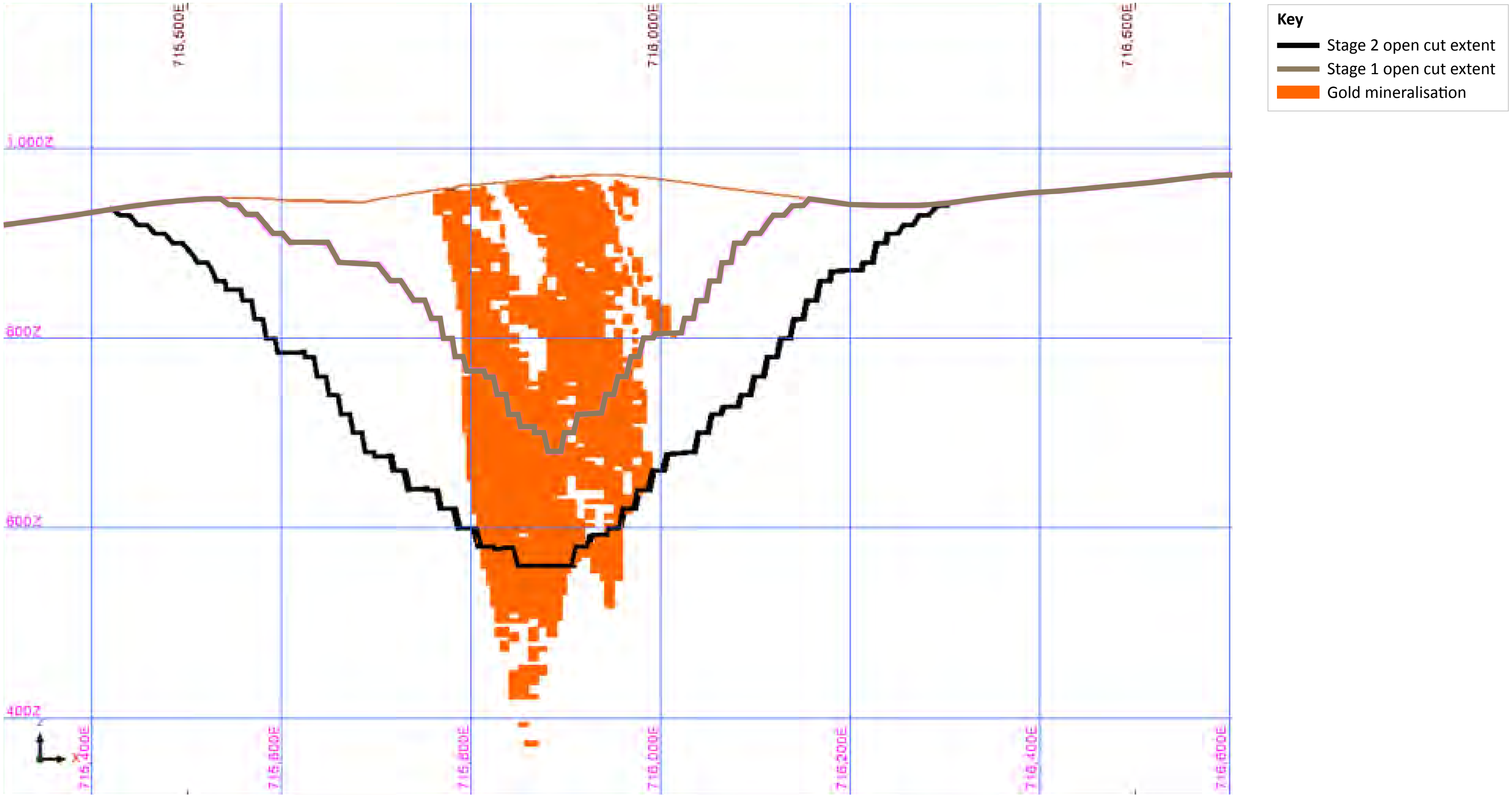
2.6.2 Ore and waste rock extraction

Regis proposes to extract approximately 60 Mt of ore from a single open cut pit over the life of the project. Ore will be extracted at an average rate of approximately 7 Mtpa, up to 8.5 Mtpa. Mining operations will occur 24 hours a day, seven days per week, and are expected to last approximately 10 years of the total 15 year project life.

Due to the generally cylindrical shape of the mineralisation, a cone shaped open cut is proposed, with the widest point at the surface, and decreasing in diameter with depth. The open cut has been designed to minimise the surface area disturbance for the quality of material extracted, so the area of impact is relatively small compared to excavation quantities.

Conventional open cut mining methods are proposed for the mine development. As much of the material to be mined in the open cut is fresh rock, nearly 100 % of the rock will require drilling and blasting to facilitate efficient loading and hauling of ore and waste.

Once the material is fragmented, hydraulic excavators will be used to load material into a fleet of haul trucks. Ore will be transported to the ROM pad, and waste rock will either be used for earthworks within the mine project area or hauled to the waste rock emplacement area for disposal.



Gold mineralisation cross section (6292300 mN)

McPhillamys Gold Project
Environmental impact statement

Figure 2.5

i Open cut design and development strategy

The open cut forms an inverted cone, with a diameter at the surface of approximately 1050 m, and deeper pit shells generally expanding concentrically to a final depth of approximately 460 m. Two open cut stages will be developed. The first stage is a smaller cone shaped open cut approximately 700 m in diameter and nearly 300 m deep, used to reduce early strip ratio and allow earlier access to ore, located in the centre of the larger second (final) stage open cut pit. Once several benches of the first stage are progressed, the second stage will commence, and will lag the first stage by a few benches.

Overall slope angles for the final open cut range from 42 to 48 degrees, with differences mainly driven by a clay zone associated with the Sherlock fault. A secondary access ramp will be developed to reduce the risk of relying on one ramp for the entire open cut.

The indicative mining extraction schedule is shown in Figure 2.6. Total material extracted over the life of the mine is expected to be approximately 109 million bank cubic metres (Mbcm). Extraction will be relatively low during mine development activities in Year 1, before rapidly increasing in extraction to peak at approximately 23 (Mbcm) in Year 2. Due to the cone shaped design, as the open cut progressively deepens extraction of material will progressively decline. Once the first stage of the open cut is exhausted early in around Year 6, the second stage will continue to be mined with a commensurate reduction in material movement rates. As for the overall project schedule, this may vary from that shown in Figure 2.6 to account for detailed mine design, mine economics, geological conditions, market conditions or relevant approval conditions.

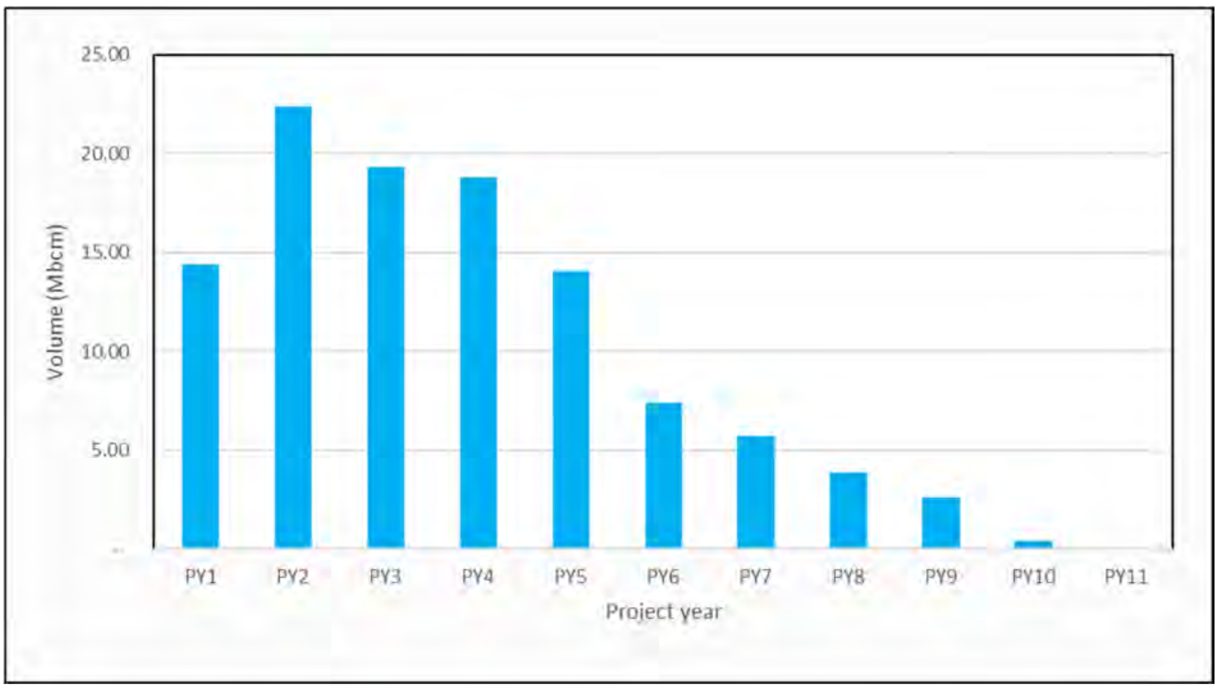


Figure 2.6 Indicative Material Movement Schedule

ii Mining fleet

The mining fleet will vary throughout the life of the project depending on the size and depth of the open cut, the volume of material to be moved and waste rock haul distances. An indicative mining fleet (subject to supply by a mining contractor to be engaged post approval) is shown in Table 2.3.

The peak mining fleet will be required in around Year 2 to Year 5 of the project; after which point requirements will reduce over time. Key mobile equipment (haul trucks, drill and excavators) will have noise suppression packages fitted to reduce impacts.

Table 2.3 Indicative mining fleet

Equipment	Number
360 t hydraulic excavators	3
250 t hydraulic excavators	1
Primary haul trucks	26
Secondary haul trucks	3
Haul trucks (rehabilitation/prestrip fleet)	3
Production drill	4
Ancillary drill	2
Tracked dozer	3
Wheel dozer	2
Grader	2
Water cart	2
Front end loader (ROM Pad)	2

The following key ancillary mining equipment will also be used:

- pumps;
- lighting plants; and
- light vehicles.

As discussed in Section 2.5.10, this mining fleet will be reduced or relocated during night time operations prior to completion of the southern amenity bund to manage night time noise levels. The anticipated daytime and night time mining fleets over the mine life have been incorporated into the noise and air quality modelling carried out for mine development refer Appendix L Noise and Vibration Impact Assessment (Muller Acoustic Consulting 2019a) and Appendix M Air Quality Impact Assessment (EMM 2019c).

2.6.3 Blasting

Rock within the open cut pit will require blasting via the controlled use of explosives to enable efficient and safe removal of ore and waste rock from the open cut by excavators and haul trucks. Blasting is likely to be conducted on a one blast per day basis. Blasting will be carried out between the hours of 8:00 am to 4:00 pm, as recommended by the air quality assessment (refer to Section 11.5.3), Monday to Saturday. Blasting will generally not be carried out on Sundays and public holidays.

Blasting activities will be designed and carried out to meet EPA blasting criteria and manage potential impacts upon adjacent land uses. A notification procedure will be developed to notify nearby receivers prior to blasting events and real time monitoring of overpressure and vibration will be carried out.

Blasting material, including explosives and ammonium nitrate emulsion will be stored approximately 1 km to the north north-west of the open cut, as shown in Figure 2.1, in a facility designed to meet the separation and design requirements in *AS2187.2 2006 Explosives – Storage, Transport and Use.* The management of hazardous materials is discussed in detail in Chapter 18.

The noise and vibration impact assessment prepared for the mine development includes an assessment of blasting overpressure and vibration impacts (refer Appendix L). A summary of the assessed impacts and proposed management measures is provided in Chapter 10. This assessment concluded that a maximum instantaneous charge (MIC) of 300 kg will ensure that the relevant overpressure and vibration limits are met at nearby residences.

2.6.4 Open pit dewatering

Hydrogeological investigations indicate that the water table in the area subject to mining is approximately 15 m to 35 m below existing ground level. As material below the water table is removed, groundwater will seep into the open cut from the intersected saturated strata. Collection of this water to facilitate dry and safe mining conditions will be carried out via in-pit sumps.

Appendix K contains the groundwater assessment for the project (EMM 2019a) including estimates of groundwater inflows into the open cut. Predicted mine dewatering rates will peak in around Year 2 at an average rate of 2,430 kL/day and decline to an average of 830 kL/day in Year 10.

2.7 Waste rock management

During mining operations, overburden and material that has insufficient gold mineralisation to justify processing, will be removed from the open cut and either be used for earthworks within the mine project area or hauled to the waste rock emplacement area for disposal. It will not be possible to progressively refill the open cut as mining progresses due to the vertical nature of the deposit and the single circular open cut mine. Refilling the open cut at the end of the mine life would be prohibitively expensive and result in prolonged amenity impacts.

The majority of the waste rock is contained within the upper third of the open cut, so material movement requirements will be steady in the first half of the mine life in order to supply a consistent quantity of ore per year to the processing plant, and will then decrease in the second half of the mine life.

The volume of waste required to be extracted to access the ore reserve is approximately 88 Mbcm. To determine the waste rock storage volume required, an average swell factor of 1.3 has been assumed; accordingly, approximately 114 Million loose cubic metres (Mlcm) of storage volume has been allowed.

Based on the above estimates, the designed waste storage capacities for the mine development are shown in Table 2.4. The total volume available is approximately 9.7 Mlcm more than is required using the assumed swell factor, with a contingency of approximately 8 % included in the waste emplacement volume capacity to account for uncertainty over the swell factor pending validation during actual mine operations.

Table 2.4 Indicative waste rock storage volumes

Location	Approximate storage quantity (Mlcm)
ROM Pad	4.6
TSF embankments	5.2
Haul roads	1.7
Waste emplacement area including southern amenity bund	102.0

Table 2.4 Indicative waste rock storage volumes

Location	Approximate storage quantity (Mlcm)
Pit amenity bund	2.7
Water management facility embankments	3.0
ROM capping (during decommissioning phase)	4.5
Total	**123.7**

2.7.1 Waste rock geochemistry

Substantial waste rock geochemistry test work and analysis has been carried out on all waste rock types at McPhillamys by SRK. The test work has indicated that some of the mineralisation associated with sub-economic ore contains sulphide minerals that if left exposed to air and water for long periods may be potentially acid forming (PAF). Over the life of the operation approximately 42 % of the waste rock is expected to be PAF.

The Geochemical Characterisation (SRK 2019) (refer to Appendix G) found much of the NAF material to be extracted from the open cut is highly neutralising and can be used to neutralise any potential generation of acidic material in the PAF material. There is sufficient NAF waste rock material available within the open cut over the life of the mine to encapsulate all PAF material and prevent any potential longer-term issues with acid mine drainage.

PAF waste rock encountered early in the development of the open cut will initially be encapsulated within the ROM pad and subsequently, the southern amenity bund. During mining operations PAF will be encapsulated in the waste rock emplacement. To encapsulate the PAF, a minimum 5 m thick NAF waste rock base layer will be constructed, on top of which PAF can be placed. Once the PAF cells within the waste rock emplacement have been established, it will be progressively encapsulated by a minimum of 5 m of NAF material. The top of the encapsulated PAF cell will then be compacted to form a relatively impervious layer, thus reducing the ingress of air and water into the PAF cell.

As a proportion of waste rock mined, PAF content increases with mine life; ie lower amounts of PAF material are generated early in the mine life compared to later in the mine life. Some NAF material will therefore be stockpiled in the latter stages of the mine life to cap the final PAF cell in the waste rock emplacement, as the final benches at the base of the open cut are not expected to yield sufficient NAF for this purpose.

2.7.2 Scheduling of waste rock emplacement

The waste rock emplacement will be constructed in a south to north direction to minimise the overall amenity impacts of the mine development on Kings Plains to the south, as illustrated in the series of mine progression plans in Figure 2.4. The evolution of the waste rock emplacement design in consideration of potential off-site impacts is described in Chapter 6 (project evolution and alternatives) and in Chapter 10 (noise). This scheduling will enable the southern face of the waste rock emplacement (shown as the southern amenity bund in Figure 2.1) to be constructed first and to its final landform height, so that it can then provide a barrier behind which mobile plant will generally operate throughout the rest of the mine life. However, this will result in noise and visual impacts on the local community being highest early in the mine life while the southern amenity bund is under construction.

As noted in Section 2.5.4, the southern amenity bund is expected to be constructed between Year 1 and Year 4 of the mine life. This indicative schedule balances the requirement to manage early development of the open cut in relation to the management of PAF material, the demand for NAF waste rock material to construct other site infrastructure such as the TSF embankments, and the requirement to manage night time noise levels on Kings Plains. Detailed mine design will aim to optimise the mine scheduling and in particular the waste dumping schedule to construct the southern face of the waste emplacement area as soon as practicable within approved noise limits to provide noise and visual bunds for the remainder of the project life.

Once the southern amenity bund is complete, placement of waste rock will progress in a south to north direction with dumping generally behind previously dumped waste rock.

Careful consideration of the final landform of the mine project area has been made when designing the waste rock emplacement to ensure as much ongoing rehabilitation on the southern amenity bund and subsequently the waste rock emplacement can be completed during mining operations (refer Figure 2.4b-2.4e).

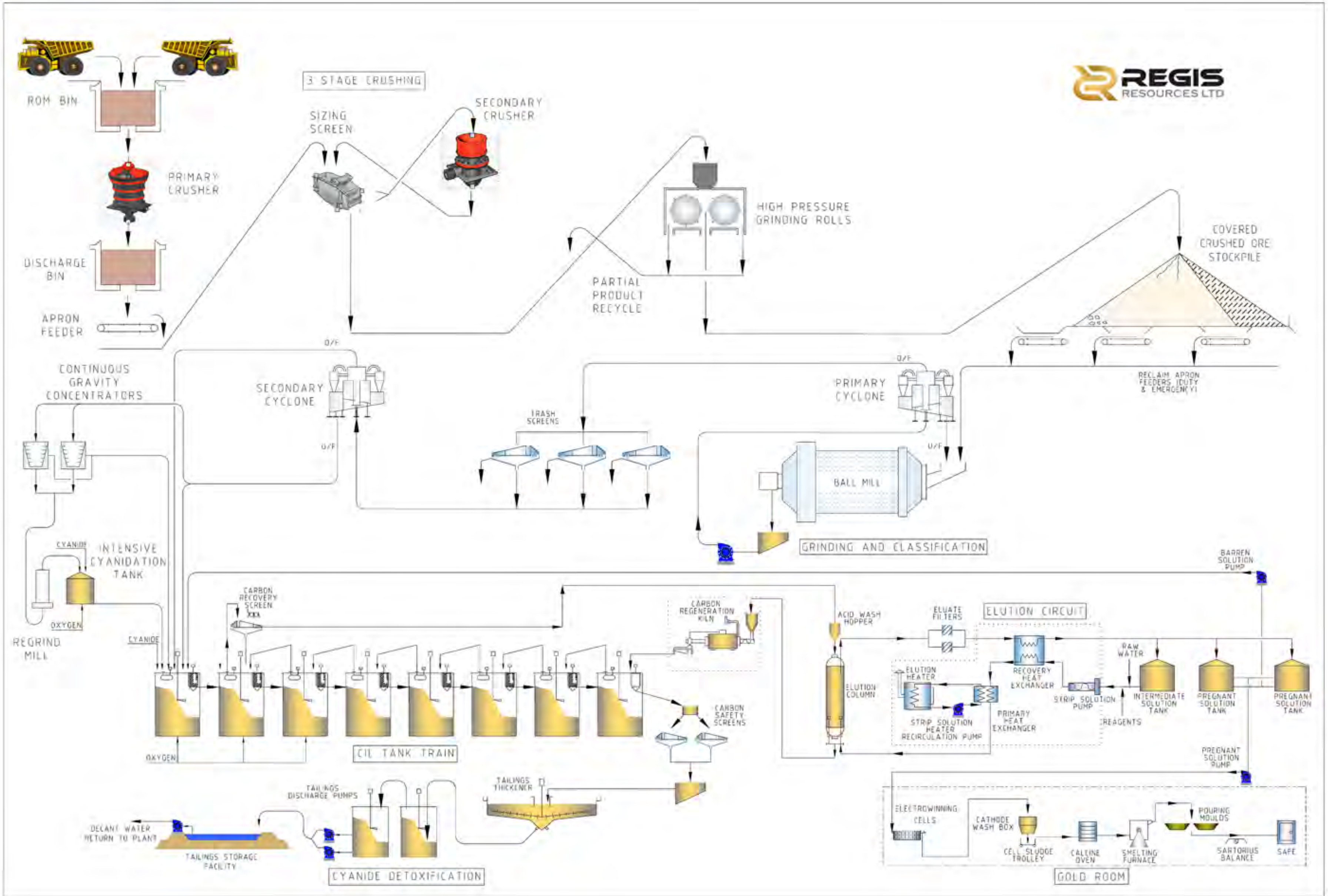
2.8 Ore processing

Ore will be processed within a conventional carbon-in-leach (CIL) processing plant. CIL processing is a gold recovery method used in NSW and more broadly in Australia and around the world for the recovery of gold and other metals, including by Regis at its Duketon Gold Project operations in Western Australia. The proposed processing plant will have a nominal throughput of approximately 7 Mtpa. Figure 2.7 presents an indicative process flow sheet for the proposed processing operations, while Figures 2.8 and 2.9 show the general arrangement and an indicative 3D model of the processing plant, respectively.

The processing operations will include the following main activities:

- stockpiling and blending of ore at the ROM pad;
- primary, secondary and tertiary crushing circuits;
- crushed ore stockpile and reclaim;
- grinding and gravity recovery and ultra-fine grinding;
- leaching and adsorption;
- elution, electrowinning and smelting;
- tailings thickening; and
- cyanide detoxification treatment.

The following sections provide a description of each of the above components, as well as descriptions of commissioning activities and the reagents required for ore processing.



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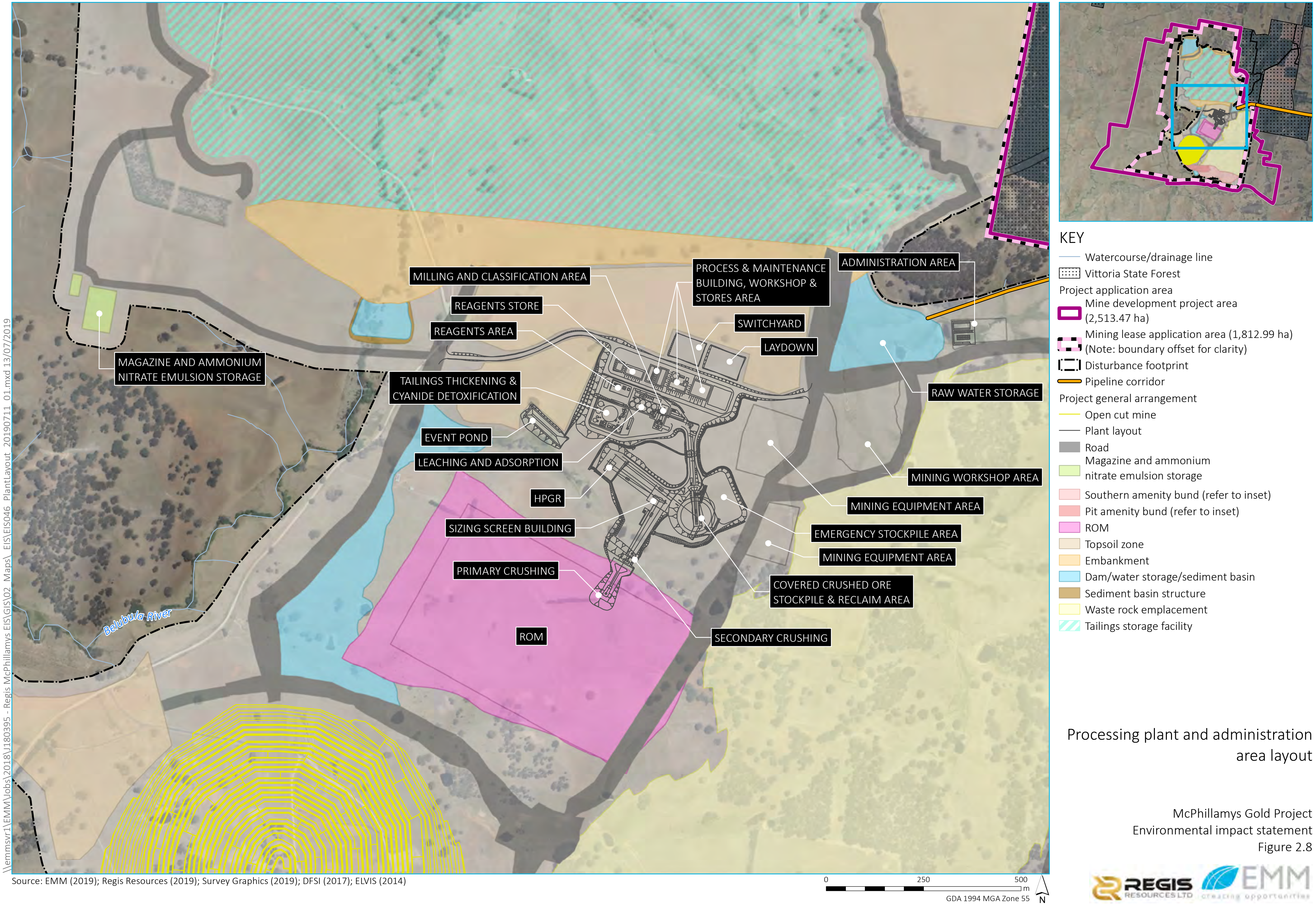
Processing plant schematic

McPhillamys Gold Project
Environmental impact statement

Figure 2.7



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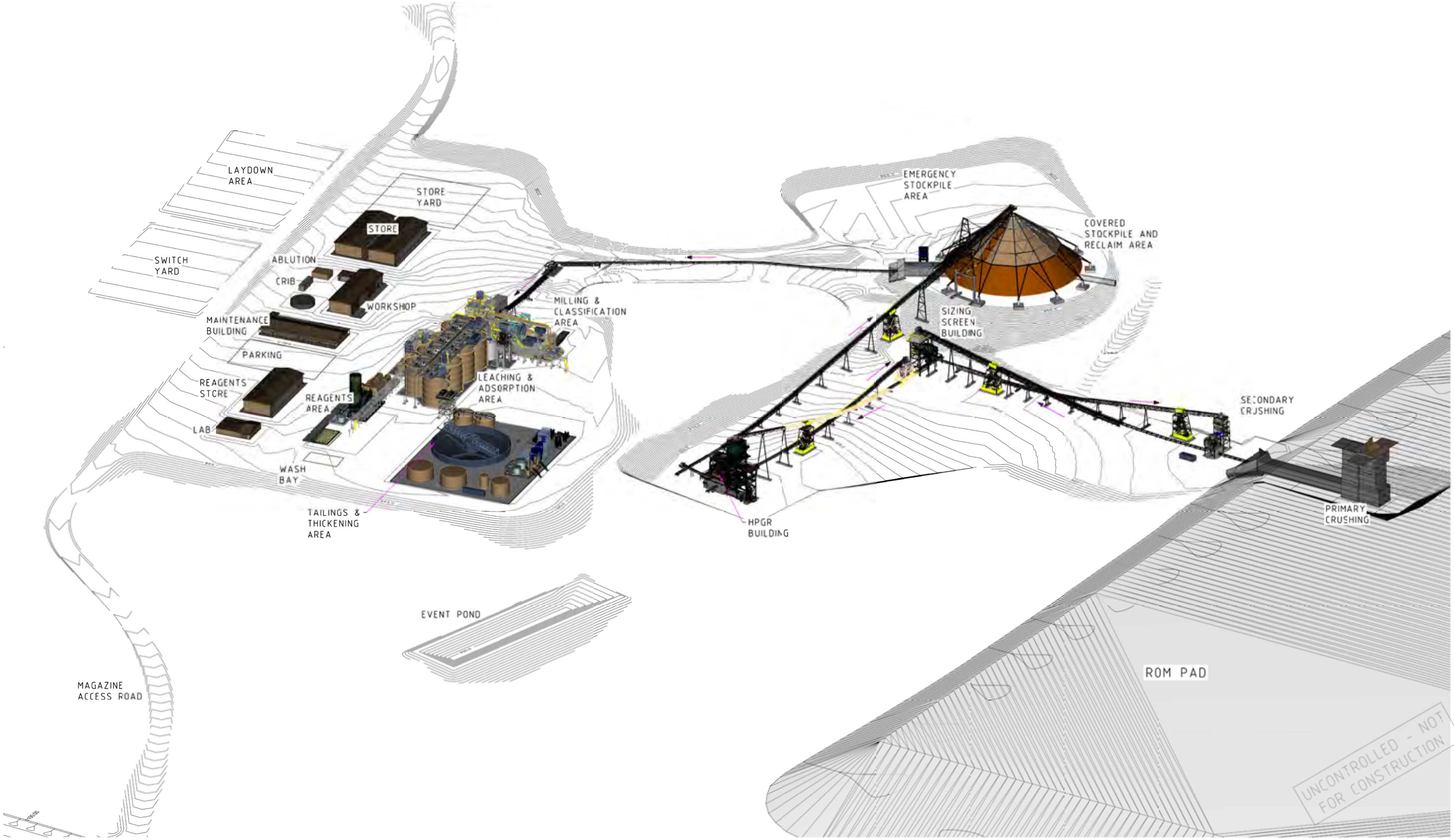
Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

Processing plant and administration area layout

McPhillamys Gold Project
Environmental impact statement
Figure 2.8



Processing plant general arrangement 3D model

McPhillamys Gold Project
Environmental impact statement

Figure 2.9

2.8.1 ROM pad operations

The ROM pad will be adjacent to the primary crushing building and will have a maximum capacity of around 1.0 Mt to 1.2 Mt. The ROM pad will have the capacity to accommodate a number of low-grade ore stockpiles which will be built up and reclaimed over the life of the mine so that the processing plant can be fed at a nominal rate of 7 Mtpa of ore. The low-grade stockpiles will ensure that adequate ore is available to manage the detailed mine planning requirements and sequencing that may change over the life of the mine, while maximising the delivery of high grade material to the processing plant early in the mine life.

Ore will be transported by haul trucks from the open cut and will be dumped either directly into the ROM bin, which will supply the primary crusher, or onto the ROM pad onto variously graded stockpile fingers. A front end loader will load the ROM ore from the graded stockpile fingers to the blend determined by the processing department and deposit the ore directly into the ROM ore bin.

The ROM pad has been sufficiently sized to allow a safe operating traffic management system for dump trucks and front end loaders. The design of the ROM bin will allow direct tipping of ore from haul trucks at two locations, which will reduce "ramping" of the haul fleet.

Low grade ore, which has a gold content that is not considered economic at the time it is mined, but which may be considered appropriate for processing at a later date, may also be stockpiled adjacent to the waste rock emplacement area in a manner which would enable it to be extracted and processed in the future.

2.8.2 Crushing circuit

The crushing plant is designed for 365 crushing days a year, 24 hours per day, with plant utilisation of 70 % and a nominal throughput of 1,142 dry tonnes per hour (dt/h) of ore.

The primary crusher will be fed by gravity from the dual-dump ROM bin. The primary crusher will be a gyratory crusher which will reduce the size of the ROM ore from nominally up to 800 mm in diameter to less than 250 mm. The crushed ore will be withdrawn from the primary crusher discharge chamber by an apron feeder, which will deliver it onto the primary crusher conveyor.

The crushed ore will subsequently be sized at a screening station where oversize ore will be directed for secondary crushing and undersized ore directed to the tertiary high pressure grinding rolls (HPGR) circuit. The secondary crusher will be operated in closed circuit with the screen to achieve a crushed ore size of less than 40 mm before directing ore to the tertiary HPGR circuit which will crush the ore further to less than 7 mm.

A primary and secondary crushing dust suppression system will be installed to collect dust from around the primary and secondary crusher circuits, specifically from transfer points. Collected dust will be slurried before being pumped to the grinding circuit.

2.8.3 Crushed ore stockpile and reclaim

The crushed ore will then be transported via conveyors to a covered conical stockpile. This stockpile will have a capacity of approximately 11,000 t, a diameter of approximately 70 m and a height of 27 m. The crushed ore will be reclaimed via two apron feeders installed in concrete vaults within a concrete tunnel below the stockpile. The feeders will deliver the fine ore at a controlled rate onto the mill feed conveyor.

2.8.4 Grinding and gravity recovery circuit

Lime will be added to the crushed ore on the conveyor prior to the grinding mill to elevate the pH within the CIL circuit. The crushed ore will then be combined with water in the grinding mill and the rotating action of the mill combined with mill ball charge using grinding balls will further reduce the ore particle size.

The ground ore slurry will then be passed through a hydrocyclone classification circuit where coarser particles will be separated and reintroduced to the grinding mill, whilst finer particles, approximately 150 µm (0.15 mm) or less, are directed to the gravity recovery circuit.

The gravity recovery circuit will separate higher density particles from the slurry for regrinding to a finer size prior to being directed to the CIL circuit, whilst the lower density particles from the slurry will be directed to the CIL circuit without any additional grinding.

2.8.5 Carbon-in-leach circuit

The proposed CIL circuit will consist of eight agitated leach tanks, each approximately 2,500 m^3 in size. The ultra fine grind ore slurry stream will be added to the first and second leach tanks after which they progressively flow to the final leach tank. Oxygen and cyanide solution will be added to the leach tanks to leach (or dissolve) the gold particles into solution. Each tank will be fitted with a dual impeller mechanical agitator to ensure uniform mixing. All tanks will be fitted with bypass facilities to allow any tank to be removed from service for agitator or intertank screen maintenance.

The addition of lime during the grinding circuit ensures that sufficient cyanide (diluted to approximately 300pm concentration) is maintained over the approximate time frame of 16 hours that it takes for the slurry to flow through the eight leach tanks.

Activated carbon granules (nominally 2 mm to 4 mm in size) will be added to each of the eight leach tanks. Screens with an aperture of approximately 1 mm are located at the outflow point of each of the leach tanks and act to contain the larger activated carbon particles within each of the leach tanks, whilst at the same time allowing the finer slurry particles (less than 0.15 mm) to pass through the screens to each successive leach tank.

The activated carbon particles in each leach tank adsorb the soluble gold cyanide from the solution onto their large porous surface. The activated carbon particles are then pumped in the opposite direction to the ore slurry each day, from the final leach tank ultimately to the first leach tank over a one to two week period. From there, a proportion of the activated carbon particles can be removed and directed to the desorption circuit on a daily basis.

The tanks will be constructed on concrete ring beams in a bunded area with a sloping concrete floor with the bunds being designed to hold 110% of the volume of a single leach tank. Any spillage from the circuit will report to one of two sumps located on the periphery of the bunded area and will be pumped back to the circuit. In the highly unlikely event of a catastrophic tank failure (ie failure of more than one leach tank), runoff will be directed through the plant site drainage system, to an appropriately sized environmental containment pond (event pond) adjacent to the processing plant (refer Figure 2.9).

2.8.6 Gold desorption, electroplating and smelting

Activated carbon particles that have adsorbed soluble gold and which have been removed from the first leach tank (loaded carbon) are then washed clean of slurry and added to the desorption column. The soluble gold which is readily adsorbed to the porous activated carbon particle surface at lower temperature (less than 50°C) can then be desorbed (removed) from the porous activated carbon surface at higher temperature (greater than 100°C).

The higher temperature solution is passed through the desorption column containing the activated carbon particles and the soluble gold is released back into solution from the porous surface of the activated carbon particle and this solution is then stored in several tanks (eluate tanks). The activated carbon particles, with the soluble gold removed, are then returned to the final leach tank and the soluble gold adsorption process repeated.

This solution containing the dissolved gold is then passed through electroplating (electrowinning) cells where the gold plates to either steel or stainless steel wool. The gold on the steel or stainless steel wool is then removed using high pressure water or heat and the gold powder (or sludge) is dried.

The dried gold sludge material has fluxes (purifying agent) added and is heated in a small furnace to produce a doré (unrefined gold) bar, which is securely stored prior to transport from the mine site.

2.8.7 Tailings thickening

Once the ore slurry streams have passed through the leach tanks and have had the majority of gold removed, they are described as tailings. The tailings slurry then flows to a thickener, where the slurry is mixed with a flocculant solution. The flocculant solution assists the finer particles to coagulate and settle in the thickener.

The action of the flocculant solution and a slow moving rake within the thickener causes the solid particles to settle to the base of the thickener where they can be pumped to the next stage. At the same time, the upper section of the thickener contains clear process water, which has not settled with the solid particles. This clear process water is decanted from the surface of the thickener for reuse in the process. Approximately 60% of the process water still containing lime, oxygen and dilute cyanide is able to be recycled for use in processing.

2.8.8 Cyanide detoxification circuit

The thickened slurry removed from the base of the thickener is then pumped to the cyanide detoxification circuit where oxygen and other reagents (lime, copper sulphate and sodium meta-bisulphite) are added. The reagents react with the free and weak acid dissociable (WAD) cyanide in the thickened slurry, so that the free cyanide is destroyed and the level of WAD cyanide remaining is reduced to less than 30 parts per million (ppm) (30 mg/L).

Cyanide levels of 50 mg/L WAD in storages accessible to terrestrial wildlife is accepted as the water quality benchmark for the protection of wildlife (International Cyanide Management Institute 2018 and Donato et al. 2007).

Each of the cyanide detoxification tanks will be sized with a residence time of 1 hour, which allows for a cyanide detoxification tank to be taken offline for maintenance, and still ensure that WAD cyanide levels of 30 mg/L will be achieved.

The resultant detoxified slurry will then be pumped to the TSF. This pipeline will be installed above ground, with the exception of road crossings, within an earthen containment bund. Leak detection on the tailings pipeline will be provided by pressure transmitters and flow measurement at both the start and end of the tailings pipeline which will automatically shut down the tailings pumps if a leak is detected.

2.8.9 Commissioning

The processing plant will be commissioned progressively in the following phases:

- dry commissioning;
- wet commissioning; and
- performance testing.

Dry commissioning will comprise energising of all electrical equipment and circuits, no-load running of drives, (coupled and uncoupled), conveyor alignment, checking of control systems, safety devices, interlocks, instrumentation, control loops and valve actuation of all equipment. It will include, where possible, the circulation of water through systems and testing of control sequences, and operating the equipment without ore, reagents or other process materials.

Wet commissioning will start when ore, reagents, grinding media and other process requirements are introduced to the processing plant and it is operated as a whole.

The operation of the facilities will be performed by Regis operations personnel with the assistance of specialised personnel as required, who will sign-off on the performance of equipment. Following the introduction of ore, the plant will be progressively ramped up to full production. During this time the operations personnel will receive extensive training in all aspects of the plant's operation.

Commencement of testing and commissioning activities will be subject to the connection of power to the site and the commissioning of the pipeline water supply (refer to Section 2.11).

2.8.10 Process consumables

The CIL processing method using cyanide and oxygen to recover the gold from the ore is the only feasible method for extracting gold for the project. Cyanide is currently the major lixiviant (liquid medium) used for the economic recovery of gold from complex ore bodies. Cyanide, under typical leaching conditions, is reactive and has an affinity for gold, meaning gold is preferentially leached first before it complexes with other metals such as copper, silver, zinc and iron. Possible alternative processing technologies have been investigated and were found to be either ineffective or not financially viable. These alternatives are discussed in Chapter 6 of this EIS and an assessment of alternative gold recovery methods is contained in Appendix CC.

The estimated annual consumption of typical process consumables, as well as indicative quantities to be stored on site, including reagents and LPG, are listed in Table 2.5. Hazardous materials to be transported and stored at the mine site, and the management measures that will ensure public and mine personnel safety, are discussed in detail in Chapter 18. A preliminary hazard analysis (PHA) was carried out in accordance with State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) for the project (Risk Mentor 2019a) (contained in Appendix R). This PHA determined the project does not represent an offensive or hazardous development.

Table 2.5 Process consumables estimated annual consumption and onsite storage

Reagent	Annual consumption	Storage	Description of use
Quicklime	5,000 t/y	~225 m^3 silo	Grinding and detoxification circuits
Sodium cyanide	5,700 t/y	~33 tonnes bulk storage, ~145 m^3 storage tank and ~145 m^3 dissolution tank	Carbon in leach circuit
Sodium Meta Bi Sulphate (SMBS)	3,800 t/y.	140m^3 storage tank	Detoxification circuit
Sodium hydroxide (NaOH)	140 t/y	30 m^3 storage tank	Raising pH of processing stream
Hydrochloric acid	400 t/y	60m^3 storage tank	Gold desorption circuit
Flocculant	280 t/y	3 m^3 silo and 350 m^3 storage tank	Tailing thickening circuit
Copper sulphate	550 t/y.	45 m^3 storage tank and ~27 tonnes stored on site	Detoxification circuit
Activate carbon	140 t/y	500 kg bulk bag	Carbon in leach circuit
Gold fluxes including, borax, silica, soda ash and potassium nitrate	2 t/y	Stored in 25kg bags	Smelting process
LPG	1,050 t/y	30 t bulk storage tank	Elution circuit and smelting process

In addition to the above process consumables, oxygen will also be required for the CIL circuit. Oxygen gas will be generated at an onsite oxygen plant. The oxygen plant will have a nominal production capacity of 10 tonnes per day.

2.9 Tailings storage facility

The TSF has been designed to achieve the following objectives:

- to provide for the efficient storage of tailings, while forming an operational and post-closure landform that is geotechnically competent/stable and not subject to excessive or uncontrolled emissions to the environment; and
- to provide an integral component of the total site water management system, such that releases from the system to the environment are eliminated for all but extreme conditions.

The TSF will be located on the upper tributaries of Belubula River valley in the north of the mine project area. As discussed in detail in Chapter 6, this location has been determined as the most suitable location for the TSF due to the optimal geology with respect to low to very low groundwater permeability to protect the downstream Belubula catchment and the prevailing topography which will also shield the TSF from the majority of offsite viewpoints. The valley topography also provides a relatively efficient storage in terms of embankment construction, tailings rate of raise and benefits in controlling TSF seepage.

This section provides an overview of the geochemical characteristics and storage requirement of the tailings as well as the proposed design and operation of the TSF. A comprehensive TSF definitive feasibility study for the project is contained in Appendix D, and the proposed conceptual design is illustrated in Figure 2.10.

2.9.1 TSF Risk Assessment

A TSF Risk Assessment (Risk Mentor 2019b) was carried out in accordance with AS/NZ ISO 31000:2018 *Risk Management Guidelines* to identify and evaluate potential risks relating to the TSF, in particular the potential risks and possible impacts to downstream surface and groundwater users arising from the geochemical composition of the tailings. This assessment concluded the risks associated with the TSF were “tolerable” in accordance with AS/NZ ISO 31000:2018 which classes “tolerable” as the lowest risk category (ie acceptable). As discussed in Chapter 6, the TSF Risk Assessment also identified and evaluated risks associated with different disposal options, alternative TSF designs and alternative TSF locations. The TSF Risk Assessment is contained in Appendix F.

2.9.2 Tailing geochemical characteristics

Geochemical test work carried out as a component of the geochemical characterisation (SRK 2019) (contained in Appendix G) indicates that detoxified tailings are anticipated to be elevated in sulphate ($S0_4$), selenium (Se) and fluorine (F) compared to ANZECC (2000) livestock drinking water guidelines.

The tailings are expected to be classified as PAF mainly due to elevated SO_4 concentrations, and therefore localised generation of acid mine drainage may be anticipated within the TSF where unsaturated conditions occur in beach areas. This will generate acidic water which will either collect in the decant area, where it will be collected and recycled, or seep into the tailings mass. As the tailings will contain an acid-neutralising capacity (ANC), there is expected to be a degree of neutralisation of any acidic water as it slowly moves through the tailings mass. It is possible that the contained ANC will be enough to neutralise acidity released from oxidation on beach areas during the operational life of the TSF.

The concentration of weak acid dissociable (WAD) cyanide in the tailings as it is pumped from the spigots into the TSF will be less than 30 mg/L. This level is well below the internationally accepted WAD cyanide concentration level of 50 mg/L at which bird life are considered safe (International Cyanide Management Institute 2018 and Donato et al. 2007). As cyanide is readily and rapidly broken down in sunlight and through natural degradation, the concentration of WAD cyanide in the decant pond is expected to be substantially less than the concentration in tailings as it enters the TSF.

An overview of the predicted geochemical characterisation of TSF seepage and seepage management is provided in Section 2.9.7 and discussed in detail in Chapter 9 (water resources) and Appendix K.

2.9.3 Tailings quantities and storage requirements

The processing plant will process approximately 60 Mt of ore over the project life. To ensure a conservative design of the TSF, an upper estimate of 70 Mt has been adopted. Assuming a tailings settled density (dry density) of approximately 1.5t/m^3, a tailings production of up to 70 Mt requires 46,700 ML or 46.7 million m^3 of storage.

2.9.4 Design criteria

i NSW Dam Safety Committee requirements

It is likely the TSF will be a prescribed dam under the *Dams Safety Act 1978*, and accordingly has been designed in accordance with NSW Dams Safety Committee (DSC) requirements. The DSC is the primary statutory body with the authority and expertise to ensure the safety of prescribed dams in NSW. The DSC's approach to safety is to ensure all prescribed dams meet DSC safety requirements so that:

- risks to community interests are identified, assessed and properly managed, are reduced when necessary, and are kept under review throughout the life of a dam;
- risks to public safety meet the DSC's public safety risk guidelines; and
- other risks with a potential for an adverse effect on community interests meet criteria set by the owner and agreed with the DSC.

a Consequence category

A conservative 'extreme consequence' category rating has been adopted for the TSF design in accordance with DSC (2012). Adoption of this rating ensures adherence to the most stringent design criteria, construction management and operational supervision requirements. It should be noted that a comprehensive consequence category assessment will be carried out as part of the detailed design phase of the project and will include a dam break study. This assessment may result in the downgrading to a lesser consequence category. Notwithstanding, Regis will adhere to the design criteria of an extreme consequence category.

Key design criteria for extreme consequence rated facilities are as follows:

- environmental containment freeboard - the TSF has been designed with sufficient freeboard so that it could only overflow in a 1 in 10,000 year 72 hour duration rainfall event;
- emergency spillway - the emergency spillway has been designed to accommodate up to a 1 in 10,000,000 year rainfall event; and
- earthquake rating - able to withstand earthquake shaking without an uncontrolled loss of storage due to partial or complete failure of the dam for the maximum design earthquake of <1 in 10,000 years.

As noted in Section 2.9.5 below, the mine project area has a low level of historical seismicity with no active faults identified in the region surrounding the site. The DSC notes there is a low probability of failure due to seismicity for well designed and constructed dams on solid foundations (DSC 2010a). Notwithstanding the low level and historical seismicity and low probability of failure due to seismicity, the DSC requires that all proposed significant, high and extreme consequence dams are assessed for safety under seismic loadings.

Accordingly, embankment stability analyses carried out during the TSF definitive feasibility study considers seismic effects on stability (refer Section 2.9.5). An appropriate safety under earthquake study will be prepared during the detailed design phase of the project in accordance with DSC (2010b).

ii Ongoing DSC monitoring and compliance with DSC requirements

Following approval and construction of the TSF, the DSC will continue to monitor the safety of the TSF in accordance with DSC requirements (DSC 2010a) by requiring:

- proper operation and maintenance in accordance with DSC requirements;
- regular dam surveillance using trained personnel;
- appropriate dam safety emergency plans; and
- review of all ongoing TSF information and assessments and action as required to ensure the TSF is maintained in a safe condition.

iii NSW Environment Protection Authority TSF Liner Policy and Environmental Guidelines: Solid Waste Landfills

The Environment Protection Authority (EPA)'s environmental assessment requirements relating to tailings management requested that the TSF liner system proposed for the project satisfies the EPA's tailings dam policy. Based on a letter from the EPA to the DPIE (EPA 2016) that was appended to the EPA assessment requirements for the project, it is understood that this policy is still under development. Notwithstanding, the letter outlines that the tailings dam policy will adopt a benchmark requirement for TSF liners to a achieve a maximum permeability of 1×10^{-9}m/s with a constructed clay liner of at least 1000 mm (or a geosynthetic liner) providing equivalent or better protection.

Where an alternative liner system to the above is proposed and/or where the natural geology of the site is proposed, to be used as part of the liner system, the EPA correspondence (EPA 2016) notes that the tailings dam policy will require a hydrogeological investigation and impact assessment be carried out to prove the efficacy of the liner system. Both the benchmark of a maximum permeability of 1×10^{-9}m/s and the provision to enable proponents to propose an alternative liner system of equivalent hydraulic performance is consistent with the criteria set out in the *Environmental Guidelines: Solid Waste Landfills* (EPA 2015). The TSF design report (ATC Williams 2019) has therefore referenced the *Environmental Guidelines: Solid Waste Landfills* as the relevant design criteria for the TSF liner.

Regis has accordingly carried out extensive hydrogeological investigations (EMM 2019a) and TSF soil classification, permeability and strength testing investigations (ATC Williams 2019) throughout the footprint of the TSF to determine whether an alternative TSF liner system could achieve the required hydraulic performance. These investigations found that subject to treatment (involving ripping, moisture conditioning and compaction) in situ materials are considered of low permeability (typically less than 1×10^{-9} m/s).

Given the preferred liner and overall seepage management system varies from EPA's benchmark of 1 x 10^{-9}m/s, ATC Williams (2019) also carried out a seepage control assessment to assess the value of the inclusion of various seepage management controls (including an embankment with upstream clay core, different floor lining systems, and seepage interception trench system) (refer to Appendix D). This assessment found that the preferred option for seepage management (as detailed in Section 2.9.7) of an alternative liner consisting of a thickness of 300 mm and a permeability of less than 3.3 x 10^{-10} m/s, with an equivalent hydraulic performance of a 1,000 mm thick clay liner with a permeability of 1 x 10^{-9} m/s, combined with the installation of a seepage recovery system will exceed the seepage performance (measured at the downstream toe of the TSF) of the EPA benchmark.

2.9.5 TSF design

i Design background

The TSF definitive feasibility study (refer Appendix D) assessed the following design factors in detail to confirm the site suitability and inform design considerations to produce a robust TSF design which will ensure a stable landform during construction, operation and post closure of the TSF. These design factors will continue to guide the development of the TSF through the detailed design, construction, operation and post closure phases.

- **Seismicity of project area** - the TSF site lies within Mid to Late Silurian Anson Formation which was formed some 430 million years ago. The faults in the region experienced most of their relative motion up to the mid Triassic, some 200 million years ago. The region therefore has a low level of historical seismicity with no active faults identified in the region surrounding the site.

- **Hydrological (rainfall) conditions** - including average rainfall and evaporation parameters and rainfall intensity and duration data to determine the probable maximum precipitation (PMP). The PMP informs the environmental freeboard required to ensure the TSF can contain the required rainfall event.

- **Geological setting of the project** - within the Silurian Aged Anson Formation of the East Lachlan Fold Belt of NSW, Australia belonging to the Mumbil Group consisting of carbonaceous pyritic siltstone, felsic volcanics, volcanic sandstone and limestone. The main structural features of geology within the mine project area are slightly trending faults running in a north to south direction across the proposed TSF embankment.

- **Subsurface conditions** - within the TSF area have been assessed through extensive geotechnical investigations within the TSF storage areas. These show subsurface conditions are predominantly residual saprolitic clays (formed by weathering of the underlying silurian volcanics). Test pits adjacent to creek beds and floodplains contained layers of sandy clay/clayey sand. Further geophysical investigations will be carried out across the entire footprint of the TSF to identify any features of potential concern/interest. This is in response to the findings of the Independent Technical review board (ITRB) on Cadia Valley Operations NTSF Embankment failure (ITRB 2019) which found a previously unidentified low density foundation layer as the most significant controlling factor in the NTSF embankment slump (refer iii below for further discussion).

- **Groundwater occurrence** - has been investigated by (EMM 2019b). Findings indicate that no permanent continuous aquifers are present within the site to depths of up to 20 m below ground surface. Notwithstanding, perched groundwater is known to exist and was observed in a limited number of test pits and boreholes, predominantly reporting from the upper basement (depths less than 6 m). These inflows possibly occur through drainage of fissures/fractures, which are likely recharged by direct surface infiltration of rainfall.

- **In-situ permeability** - investigations indicate that the Anson Formation at the TSF location has low horizontal and very low vertical permeability (Khor 0.002m/day, Kvert 0.0001m/day) (EMM 2019b).

- **Geotechnical characteristics** and the inferred engineering properties based on the extensive geotechnical investigations (ATC Williams 2019) include:

  - a soil profile generally of high strength (below the topsoil horizon);

  - subject to compaction/engineering, low permeability soil (typically less than 1 x 10^{-9} m/s);

  - fines fraction typically greater than 60% with the clay fraction described as medium to high plasticity; and

  - the soils considered to be moderately dispersive and as such, given the variable and sometimes high silt/sand fraction, the soil may be considered to be "erodible" on slopes when subject to concentrated stormwater flow.

- **Tailings geotechnical characterisation** - including settled density, inferred beach slopes, predicted permeability and geochemical characterisation (refer to Section 2.9.2) of deposited tailings and associated design implications (ie in terms of appropriate lining of the TSF and embankment stability).

ii TSF definitive feasibility study concept design

The final configuration of the TSF will be confirmed during detailed design; however indicatively will comprise:

- an embankment crest level of RL 962.0 m;
- a total embankment length of 2,450 m;
- a maximum embankment height of 49 m;
- a storage area (at full supply level) of 320 ha;
- an available tailings storage capacity of 49,300 ML; and
- a total storage capacity (including freeboard) of 54,700 ML.

Additional design features of the TSF include:

- sufficient storage to maintain an average rate of rise which, based on site climatic conditions will provide sufficient time for consolidation and associated high achieved densities and low permeability of the tailings mass. These are important considerations in minimising the potential of liquefaction and maximising the stability of the TSF both during operations and post closure;

- a decant structure located at the north-western extent of the TSF to recover process water for return to the processing plant. The decant structure is located away from the main embankment to drain water from the main TSF embankment. This again consolidation of the tailings and avoids the pooling of water against the main embankment thereby minimising liquefaction and potential seepage and ensuring the stability of the main embankment;

- a seepage recovery system constructed downstream of the cut-off key under the main embankment (refer to Section 2.5.7 on construction of the TSF), with seepage reporting to the trench drained to a recovery sump for return to the TSF or transferred to the processing plant;

- an emergency spillway to discharge flood inflows in the event of extreme rainfall sequences in accordance with dam safety requirements;

- full lining of the TSF storage to achieve a low permeability equivalent of less than 1,000 mm @ 1 x 10^{-9} m/s;

- clean water diversion system to divert upstream clean water catchment around the TSF and back into the Belubula River;

- a TSF runoff interception water management facility (WMF) located down gradient of the TSF across the primary drainage feature for the purpose of providing containment of runoff from the TSF embankment disturbance area as well as providing secondary seepage interception;

- monitoring bore network to detect seepage issues should they arise; and

- backup bore network downstream of monitoring network to extract seepage should issues arise.

The TSF design has been and will continue to be progressively independently peer reviewed by CMW Geosciences.

iii TSF embankment design and embankment stability analyses

The following minimum factors of safety (FoS) for embankment stability have been adopted (FoS expresses how much stronger a system/structure has been designed compared to its intended purpose):

- completed embankment – FoS of 1.3;

- steady state seepage (at maximum storage level) – FoS of 1.5;

- seismic condition (operating base earthquake) – FoS of 1.2; and

- seismic condition (maximum design earthquake) – FoS of 1.1.

ATC Williams (2019) carried out geotechnical analysis, including stability analysis to confirm the general suitability and stability of the proposed TSF embankment as well as to optimise seepage control measures (refer Section 2.9.7 for further discussion on seepage). The following embankment configuration was adopted for the purposes of the embankment stability analyses. This configuration will be refined during the detailed design phase:

- external batter slope – 4 (horizontal(H)):1(vertical (V)) average;

- internal batter slope – 2(H):1(V) average;

- crest width – 15 m;

- embankment crest level (final stage 3) – RL 962; and

- full supply (emergency spillway) level – RL 961 m.

Stability analysis with respect to the proposed TSF embankment configuration has been undertaken to confirm the suitability of the adopted configurations as outlined above. The embankment location selected for the analyses was aligned at Belubula River, the portion of the TSF embankment of greatest height. The results of the stability analyses are summarised in Table 2.6.

Table 2.6 Results of embankment stability analyses

Modelling condition	Target Minimum Factor of Safety	Modelled results
Steady state seepage	1.5	2.7
Steady state seepage with seismic effects (maximum design earthquake of 1 in 10,000 years))	1.1	0.9[1]

1. Indicates during a 1 in 10,000 year earthquake the embankment would be subject to some permanent deformation.

The results of the embankment stability analyses indicate that the nominated minimum FoS is achieved for the steady state case and that some deformation under the maximum design earthquake would be experienced (ATC Williams 2019).

Further assessment was carried out to determine the extent of potential displacement and therefore potential for partial or complete release of tailings. This analysis determined that any displacement during a 1 in 10,000 year earthquake would be negligible and significantly less than the operating freeboard of the TSF and therefore would not result in an uncontrolled release from the TSF.

Community consultation has identified concern in the community regarding the potential for the McPhillamys TSF to experience an event similar to the Cadia Valley Operations NTSF embankment slump, which occurred in March 2018. The ITRB report on this found the event occurred because of deformation in the foundations, leading to the removal of support for the tailings mass thus triggering liquefaction of the loose saturated tailings (ITRB 2019). The most significant controlling factor that lead to the event was the presence of a previously unidentified, low density foundation layer in the vicinity of the slump (ITRB 2019).

It should be noted that the residual saprolitic clays (formed by weathering of the underlying silurian volcanics) subsurface conditions in the mine project area differ from the complex geology and differential weathering profiles underlying Cadia Valley Operations (ITRB 2019). Nevertheless, in response to the findings of the ITRB report, Regis has increased the depth of existing geotechnical boreholes under the TSF main embankment and will carry out further geophysical investigations over the footprint of the proposed embankment to identity features of concern or interest which may require further considerations during the detailed design phase.

2.9.6 Operation of the TSF

The TSF will be developed in stages to match the extraction of waste rock from the open cut pit used for embankment construction and to cater for the rate of rise in tailings. The indicative stages will be as follows and as illustrated in Figures 2.3 and 2.4a-2.4e:

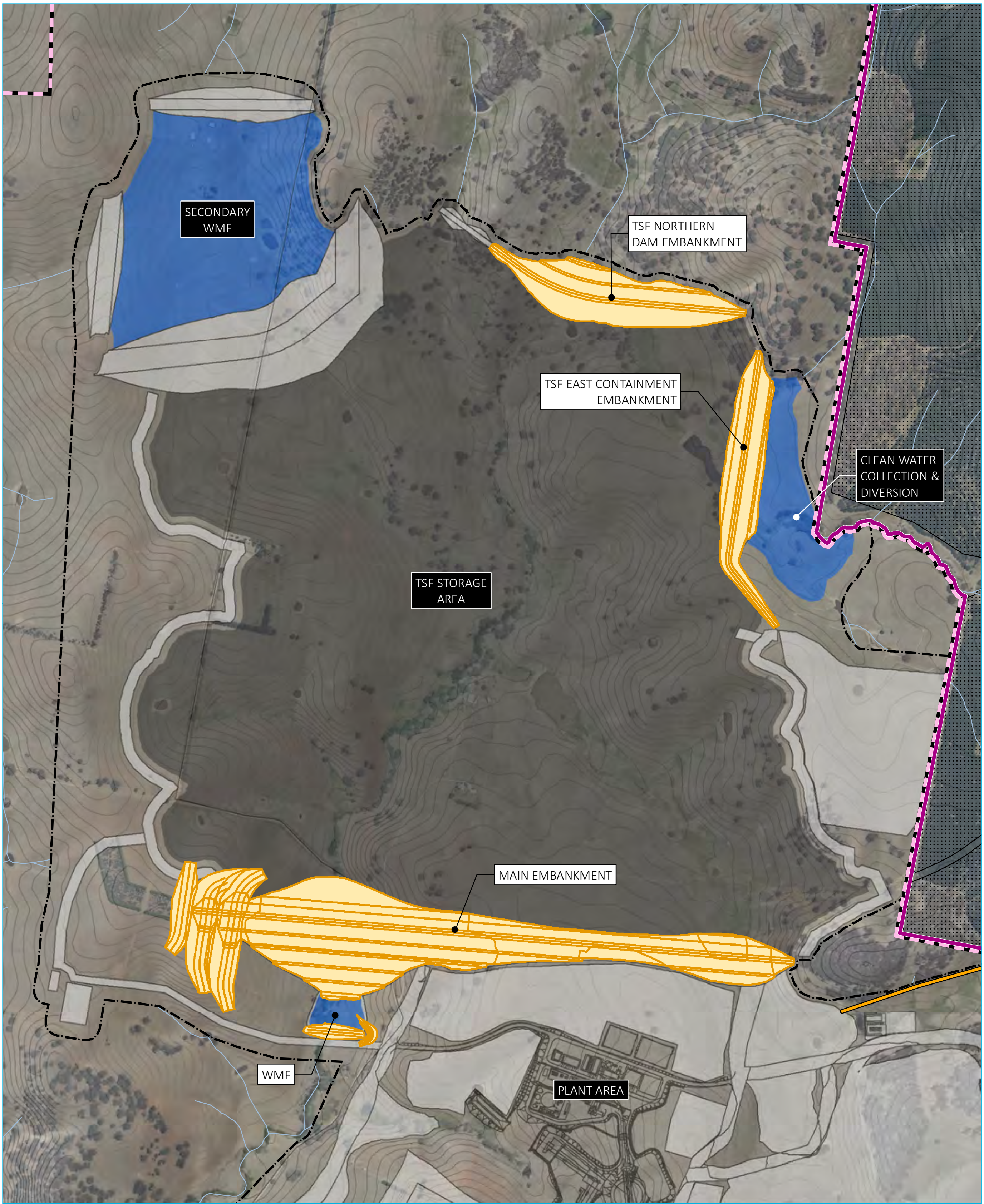
- Stage 1 - Constructed prior to the start of processing operations and available to store the first two years of tailings production plus freeboard requirements;
- Stage 2 - Constructed prior to the filling of Stage 1 (before two years of processing operations), the Stage 2 TSF will accommodate around three years of tailings production whilst maintaining the required freeboard; and
- Stage 3 - Constructed prior to the filling of Stage 2 (approximately after four years of processing operations), the Stage 3 TSF will accommodate the remaining tailings production and maintain the required freeboard.

Tailings will be discharged into the TSF using subaerial techniques from multiple locations on the perimeter of the TSF. At each discharge location, the tailings slurry will produce near laminar flow over the gently sloping tailings beach to enable settling of tailings solids. Subsequent evaporation from the exposed beach surface in conjunction with controlled seepage will consolidate the tailings.

Water liberated from the tailings through the deposition phase will accumulate within a decant pond decant at the toe of the beach, from where it will be recovered for use in the processing facility. The discharge locations will be varied regularly, up to multiple times per day, to ensure that the tailings are evenly distributed and to maximise the area of damp tailings to minimise dust emissions.

Operational monitoring of the TSF will include:

- regular (and after significant rainfall) inspections of the physical condition of the embankment, spillway, tailings and return water pipelines, seepage system and clean water division system;
- annual dam safety inspections carried out by a suitably qualified and experienced engineer to review monitoring data and inspect TSF and ancillary infrastructure;
- monitoring of pumped TSF tailings inflow, decant water outflows, seepage recovery rates, tailings rate of raise levels and tailings beach development surveys; and
- groundwater and downstream surface water monitoring.



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); DFSI (2017); GA (2011)

0 250 500 m
GDA 1994 MGA Zone 55
N

KEY

- Watercourse/drainage line
- Contour (2.5 m)
- Vittoria State Forest

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- TSF design
- Water management area
- Tailings storage facility
- Other mine layout elements

TSF concept design

McPhillamys Gold Project
Environmental impact statement
Figure 2.10

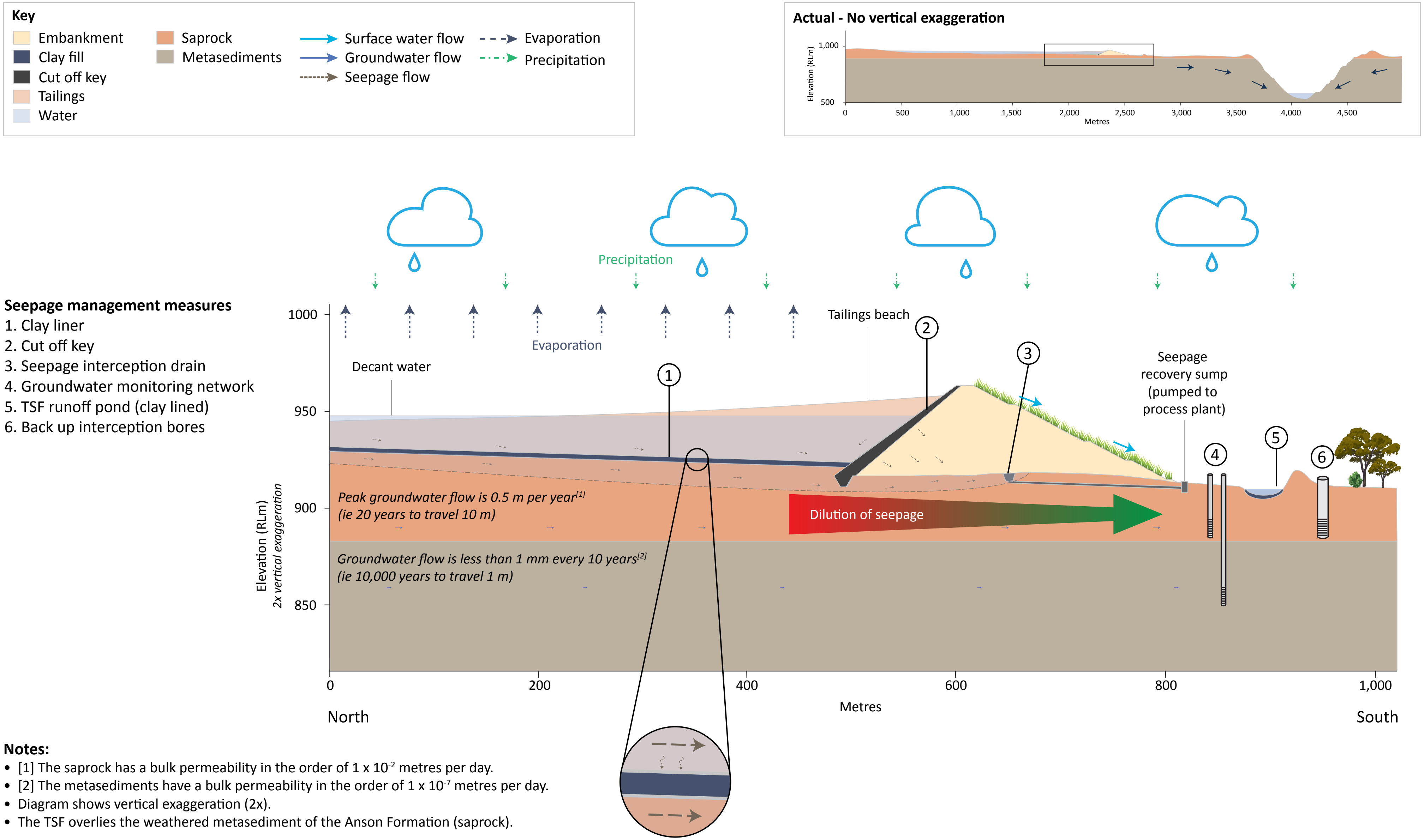
2.9.7 Seepage management

The design of the TSF includes safeguards for seepage management including:

- the embankment foundations will be cleared, stripped and excavated to remove weak, compressible or over-saturated soils;
- the in situ material (surface geology) has a low hydraulic conductivity and will therefore minimise the vertical movement of seepage from the TSF;
- the floor of the TSF will be conditioned or lined to achieve or exceed EPA's permeability requirements (refer to Section 2.9.4 above);
- TSF embankment will be constructed with an upstream low permeability clay lined zone;
- installation of a clay cut off key below the clay lined zone of the embankment, which will extend to low permeability basement geology;
- a drain will be constructed at the toe of the main embankment, which will capture seepage from the TSF and will then be recirculated back to the TSF decant area;
- groundwater monitoring bores will be installed around the TSF to monitor for early warning of potential seepage from the TSF; and
- downstream of the monitoring network, seepage interception bores will be in place to operate as backup seepage collection points to intercept any potential seepage before it progresses further into the catchment (ie downstream towards the Belubula River).

A schematic of the proposed seepage management system is presented in Figure 2.11. In addition to the above design controls, the TSF will be operated such that the tailings within the TSF achieve a maximum density and minimum permeability. The proposed lining of the TSF is described further in Section 2.5.7.

It should be noted, the results of the groundwater assessment (refer Appendix K) indicate that even without all seepage management measures in place, any seepage that may migrate through the hydrostratigraphic units (units that act as aquifers or aquitards) towards the Belubula River will have concentrations below the observed baseline surface water quality concentrations, ANZECC (2000) livestock drinking water and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values (for analytes with elevated concentrations in the tailings liquid fraction results) (EMMa 2019).



Notes:

- [1] The saprock has a bulk permeability in the order of 1 x 10^{-2} metres per day.
- [2] The metasediments have a bulk permeability in the order of 1 x 10^{-7} metres per day.
- Diagram shows vertical exaggeration (2x).
- The TSF overlies the weathered metasediment of the Anson Formation (saprock).

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Tailings storage facility - seepage management schematic

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Environmental impact statement

Figure 2.11

2.10 Water management

2.10.1 Water demand and supply

i Construction and development of the open cut

During early construction and open cut development activities water will be used predominately for dust suppression and machinery washdown. Prior to commissioning of the pipeline, water will be derived predominately from rainfall runoff captured in accordance with Regis' harvestable rights entitlement.

Prior to the commissioning of the pipeline development before the end of Year 1, there may be a shortfall in construction and dust suppression water. Potential shortfalls will be managed by investigating alternative water supplies, such as establishing onsite production bores or production bores on neighbouring properties nearby under agreement and turkey nest storage, or purchasing and trucking water to site, and reducing haul road dust suppression water demand by the use of dust suppression agents.

ii Processing and mining operations

During the operational phase of the project, encompassing commissioning and operation of the processing plant and mining operations, water will be used for:

- ore processing;
- dust suppression;
- machinery, conveyor and vehicle washdown;
- fire protection systems; and
- amenities and other potable uses.

Demands will be met from a variety of sources including:

- pipeline water supply;
- rainfall runoff;
- groundwater (pit inflows); and
- direct rainfall.

The water balance model (HEC 2019) simulates the management of the operational water system over the life of the mine (refer to Appendix J). The model predicts supply reliability will meet the water demands of the mine development once the pipeline development water supply is commissioned and the Secondary WMF is constructed. Up until the commissioning of the processing plant, water will be pumped on demand from the pipeline water supply to ensure site water demands are met and the water management facilities have adequate storage for rainfall events.

The water balance predicts that on average the external supply provided by the pipeline development contributes the highest supply source of operational water followed by rainfall runoff from the operational areas of the mine development. The processing plant represents the highest water demand followed by water required for dust suppression.

2.10.2 Water management system

The surface water management system for the mining development is summarised in Chapter 9 and described in detail in the surface water assessment (HEC 2019) contained in Appendix J. The objective of the water management system will be to control the volume of poor quality water generated by the mine development by maximising its reuse and by limiting and avoiding the contamination of clean water.

Water will be assigned one of the following classifications based on source and expected water quality:

- clean water (ie runoff from undisturbed or established rehabilitation areas);
- operational water (ie runoff from mining areas such as haul roads, the waste rock emplacement, hardstand areas and open cut dewatering as well as pipeline supply water); or
- development/construction water (ie runoff from disturbed areas and unestablished rehabilitation which is potentially sediment-laden).

Water management infrastructure has been sized to meet the mine development water demand requirements, with the capacity to store surplus water generated by the mine development without the need to release operational water to the Belubula River. The indicative layout of the water management system is illustrated in Figure 2.12.

i Clean water management

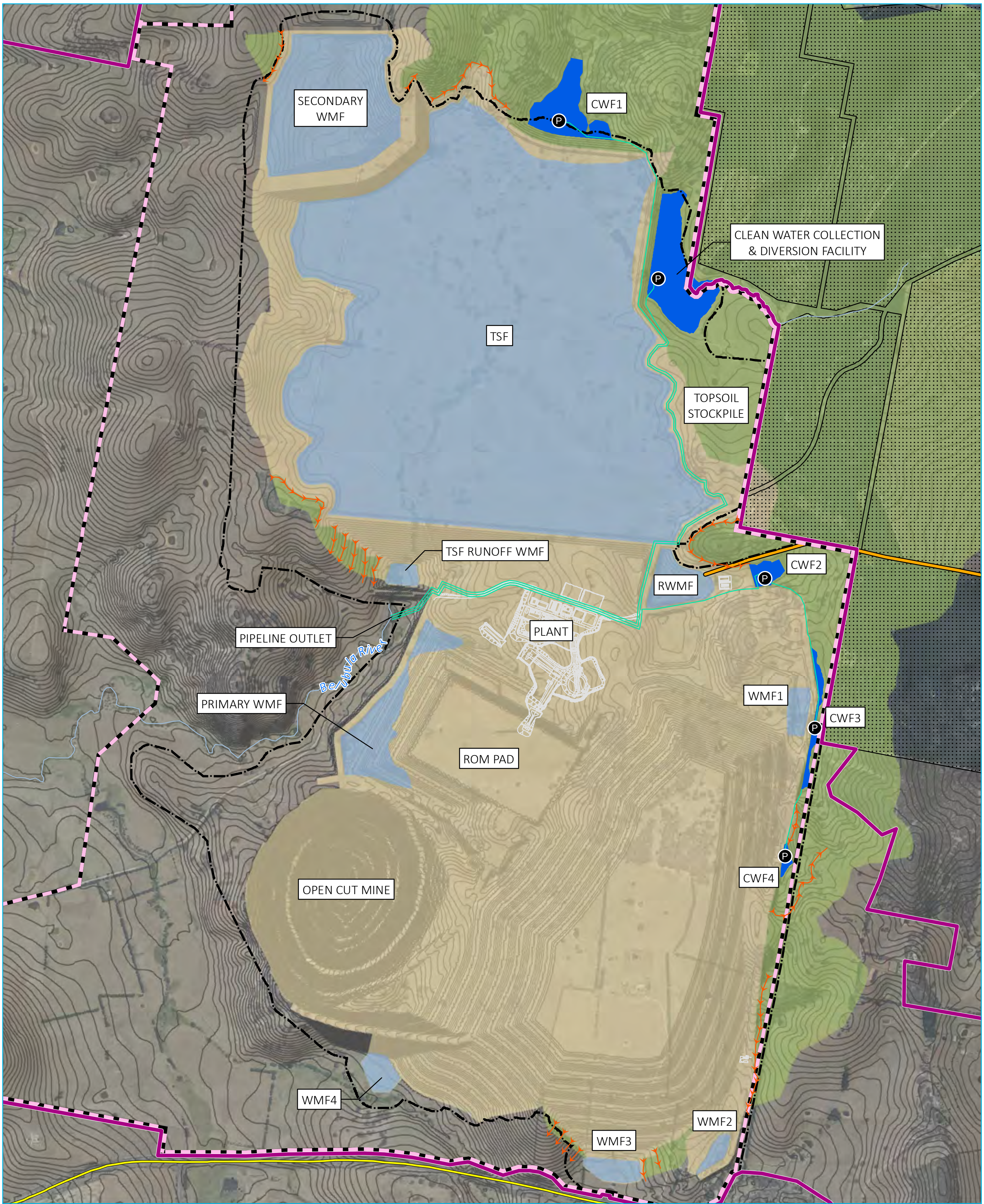
Runoff from undisturbed or rehabilitated areas is defined as part of the clean water system for the mine development. During mining, the majority of clean water will be diverted around the mine development via a series of diversion drains, dams, pumps and pipelines. Clean water will drain or be pumped to clean water diversion facilities sized to contain total runoff from a 1:100 (1%) AEP, 72 hour duration rainfall event, from there clean water will be transferred back into the Belubula River downstream of the disturbance footprint.

A temporary TSF clean water facility (CWF) will be established prior to the start of TSF embankment construction, capturing clean water upslope of the TSF main embankment. This TSF CWF will be decommissioned and the clean water collection and diversion water management facility, upstream of the eastern TSF embankment, will be commissioned prior to this time and will remain in place for the duration of the mine development. Additional temporary CWFs will be developed as required across the mine project area to maximise clean water diversion around construction and operational areas.

ii Operational areas water management system

Runoff from mining areas such as haul roads, the waste rock emplacement, hardstand areas and the open cut is defined as part of the operational water system for the mine development. The external water supplied via the pipeline will be pumped into the operational water system. The runoff from the mine development will be used as a priority to imported water to reduce the likelihood of spill from the storages within the operational water system.

The operational water management system will comprise a number of WMFs, the open cut and the TSF, together with a system of pumped transfers and drains. A summary of the WMFs is provided in Table 2.7, and Figure 2.13 shows a schematic representation of these storages and their inter-linkages for the duration of the mine development.



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); HEC (2019); DFSI (2017)

0 0.5 1 km
GDA 1994 MGA Zone 55
N

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Diversion pump
- Plant layout
- Pipeline
- Diversion drain
- Mine plan contour (2.5 m)
- Operational water storage
- Clean water collection and diversion maximum area
- Diverted catchment
- Non-diverted catchment

Existing environment

- Main road
- Belubula River
- Vittoria State Forest

Mine water management system

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Figure 2.12

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Table 2.7 Summary of operational water management facilities

WMF ID	Purpose	Indicative capacity
WMF1	Collect run off from waste rock emplacement	109 ML
WMF2	Collect run off from waste rock emplacement	109 ML
WMF3	Collect run off from waste rock emplacement	105 ML
WMF4	Collect run off from waste rock emplacement	141 ML
Primary WMF	Collect run off from processing plant and mine infrastructure area	442 ML
Secondary WMF	Main water storage on the site. Operational water captured in other storages will be pumped to this WMF	4,370 ML
Raw WMF	Store pipeline water supply prior to use in the processing plant	309 ML
TSF Runoff interception WMF	During construction of the TSF will function as a sediment basin. During operations will collect runoff from the TSF embankment and form part of the TSF seepage management system (refer Section 2.9.7)	38 ML

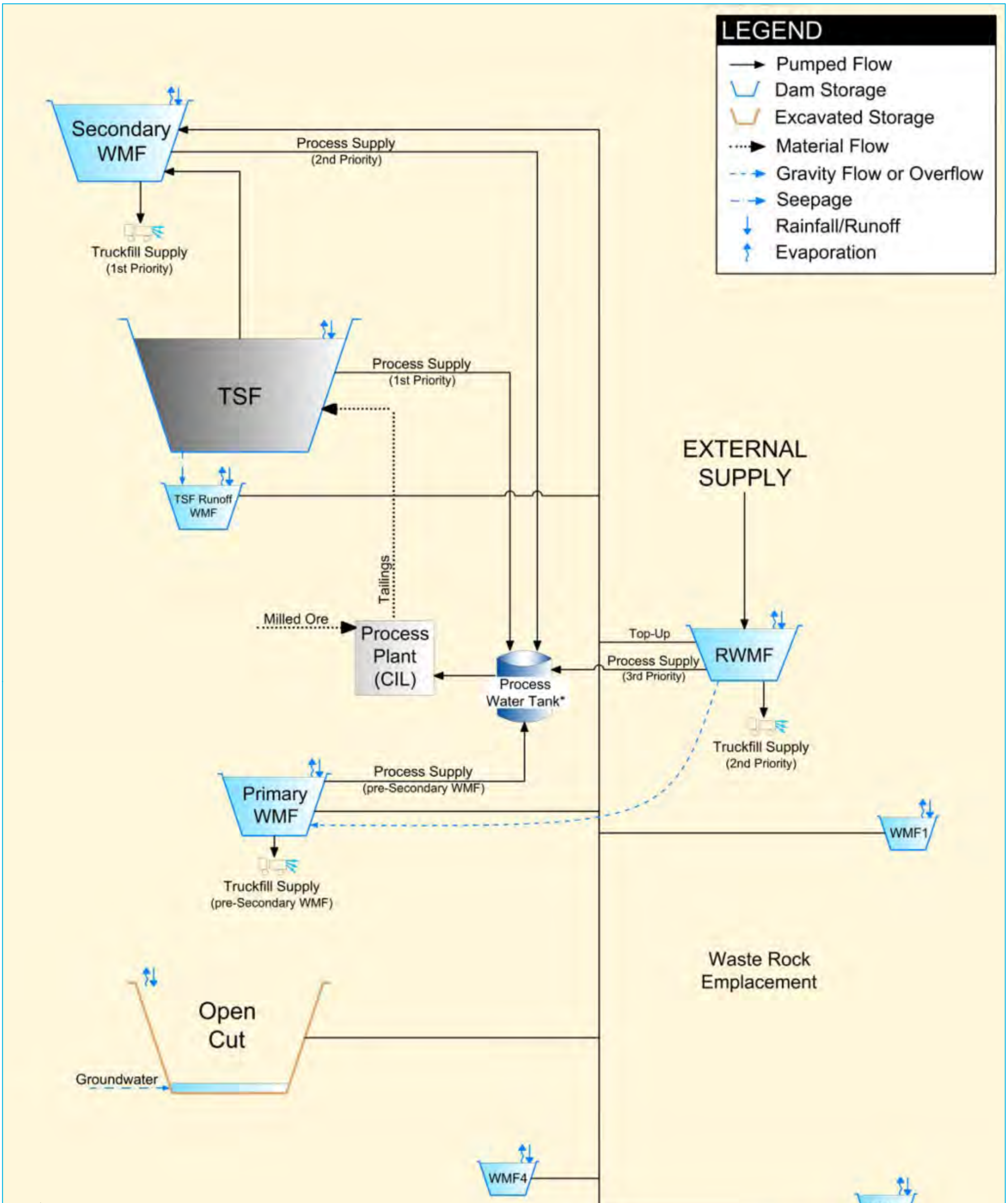
All WMFs apart from the Secondary WMF (which will spill directly into the TSF) have been designed with a conservative less than 1 % annual spill risk.

The Secondary WMF will be the main water storage on site with a capacity of approximately 4,370 ML. This WMF will have a dual purpose in that, during operation, it will allow storage of excess water from the site and at closure the waste rock used to form its embankments will be used to cap of the TSF.

Operational water captured in other storages will be pumped to the Secondary WMF which will then supply water to the processing plant and truck fill (for haul road dust suppression) as a first priority. Prior to capacity being available in the Secondary WMF operational water will be pumped to the Primary WMF.

Processing will commence during Year 2, and from this time tailings will be pumped to the TSF with water recovered from the TSF via pumping to the processing plant or Secondary WMF. The TSF run off interception management facility is located downstream of the TSF and will also serve as a sediment dam for construction of the TSF main embankment.

The Primary WMF, WMF1, WMF2, WMF3 and WMF4 will capture runoff from the waste rock emplacement and other infrastructure areas, with accumulated water to be pumped to the Secondary WMF. These WMFs spill externally hence are sized to have a spill risk of less than 1%.



* Not explicitly modelled
Note: Prior to Secondary WMF being commissioned, WMF1, WMF2, WMF3, WMF4 and Open Cut would be pumped to Primary WMF.
Note: Unless otherwise shown, storages could spill externally in accordance with the nominated design criteria (refer Section 2.10.2).
Note: Clean water diversion dams/pumps are not part of the mine water management system hence are not included on this schematic.

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Operational water balance schematic

Figure 2.13

2.10.3 Potable, wastewater and fire protection water

i Potable water

Potable water required within the administration, ablutions and office facilities will be sourced from a combination of rainwater tanks and potable water delivery to site. Groundwater production bores may also be established within the mine project area for potable use. A reverse osmosis (RO) plant will also be accommodated onsite to treat water to Australian drinking water guidelines. Waste discharges from the RO plant will be contained onsite and reused in the processing plant or disposed of in accordance with the *Waste Classification Guidelines* (EPA 2014).

ii Sewage

Sewage at the mine development will be managed in two ways:

- a package waste treatment system will be used for areas with high density personnel such as the processing plant and administration area; and
- for ablutions in areas with low or infrequent use, untreated waste will be collected in septic tanks which will be emptied by tanker as required.

iii Fire protection water

Fire water will be stored in designated tanks in the processing plant. The fire water system will comprise of a fire water main around the processing plant and infrastructure buildings including administration officers and mining equipment area and workshop. It is expected that the source of the fire water will be raw water from the pipeline development.

2.11 Mine infrastructure

Supporting infrastructure for the mine development is summarised in the following sub-sections and is shown on Figure 2.8.

2.11.1 Administration area

The site administration facilities will be located adjacent to the main site access road approximately 3.5 km from the proposed intersection off the Mid Western Highway and approximately 600 m before the processing plant area.

The administration office will cover an area of approximately 500 m^2 and will have a reception area, a mix of closed offices and open plan work stations, meeting and training rooms, kitchen facilities, male and female ablutions and ambulance park bay.

The occupational health and safety, first aid and emergency response areas will be located at the end of the administration office closest to the processing plant entrance. A training room will be provided adjacent to the administration office.

A laboratory will be located within the administration area. The laboratory facilities will treat metallurgical samples from the process plant as well as minor quantities of grade control samples.

2.11.2 Car parking

A sealed carpark covering approximately 1,902 m^2 will be provided adjacent to the administration office, accommodating 30 car bays and 2 bus bays.

An additional unsealed carpark immediately to the east of the administration building has been allowed for operations and mining contractor personnel with an area of 4,750 m^2 for approximately 135 car bays. Another area further to the east has been allowed for parking for construction personnel, with an area of 12,500 m^2 which will accommodate approximately 350 car bays and buses during the construction phase.

2.11.3 Workshop and mining equipment areas

A workshop will be established to accommodate required maintenance on mobile equipment during the life of the mine development. The workshop floor area will be bunded and designed to drain to a sump and oily water separator system.

Mining equipment areas comprising large hardstands will be established to the north of the waste emplacement area to provide parking for the mining fleet in the vicinity of the workshop.

2.11.4 Electricity supply

The mine development will have an electricity requirement of 26 megawatts (MW) to 28 MW. The project is currently exploring two separate options for the mine developments primary power supply. The first option is the duplication of the existing 66 kV line from the Panorama substation near Bathurst.

The second option under assessment is to supply the site from the Transgrid 132 kV system Line 948 which passes between Bathurst and Orange approximately 14 kilometres to north of the processing plant.

Separate approval under Part 5 of the EP&A Act will be sought to construct either option. Part 5 approval will also be obtained for a 66kV switchyard will be constructed adjacent to the site administration offices, as well as the electricity supply for the pipeline development. Consultation has commenced with Essential Energy and Transgrid relating to this power supply.

Existing power supply infrastructure within the mine project area is not suitable for reuse to supply any of the new infrastructure associated with the mine development. Existing powerlines supplying residences or farming infrastructure owned by Regis, but not forming part of the mining operations, will be left in place. Existing power line infrastructure within the mine project area impacted by mining operations will be removed.

2.11.5 Communications

The communications network for the mine development will be supplied by a communications tower structure to allow the mine site to connect directly to the Blayney township communication infrastructure. The communications tower will be located north of the mine administration building at a location suitable to provide coverage and connectivity to all other areas and points around the mine site.

General mine and plant communications will be delivered by UHF, mobile radio, local and repeater channels. Radios will be installed in all mine site vehicles and portable radios provided to mining, processing and maintenance staff.

The processing plant will be managed through a plant control system and SCADA network. These control systems will be powered by uninterruptible power supply and will provide continual monitoring of the processing plant.

2.11.6 Security

A gatehouse will be constructed on the new access road approximately 1 km north of the access road's intersection with the Mid Western Highway. Gatehouses will be operated 24 hours per day and will be linked to the administration office to control all vehicle moments and visitors to the mine development.

Alternative accesses to the mine project area (such as Dungeon Road and existing farm accesses) will be gated and locked once they are no longer required for initial site establishment activities.

2.12 Workforce

2.12.1 Construction

The peak mine development construction workforce, including processing plant and site infrastructure construction contractors and mining contractors, is anticipated to be around 590 people in Year 1, although it is noted that the number of construction workers on-site at any one time will vary throughout the year, averaging at around 480 people in this first year.

2.12.2 Operations

Regis' intent is for the workforce to reside within the local area, with operational employees generally being required to reside within an approximate 1-hour commute to the mine. This will maximise the socio-economic benefits of the project for the local community by avoiding a 'drive-in-drive-out' or 'fly-in-fly-out' workforce. This will also assist in managing fatigue for the safety and wellbeing of employees. Local suppliers and contractors will also be used wherever possible, although it is expected that some specialist tasks may require a workforce from further afield.

The projected operations workforce will fluctuate over time, generally reflecting changes in the mine production rate. The annual average operations workforce from Year 2 to Year 11 will be approximately 260 FTE persons. The peak operations workforce of 320 FTE persons is anticipated to occur in around Year 4 and Year 5 and will be associated with the increase in production within the open cut operations at this time.

2.12.3 Recruitment

Regis will develop a strategy for local recruitment, which will include recruitment programs that aim to maximise local employment. The required workforce will be sourced through a range of recruitment processes, including local and national recruitment, referrals from existing employees, apprentice, trainee and graduate programs and contract labour.

It is anticipated that approximately 15% or around 40 positions of the required operations workforce will originate from outside of the Mid-West Region of NSW as the specific skills required for a role may not be able to be sourced from the region at the time of recruitment, or Regis and the mining contractor may relocate personnel from their existing operations. Regis will encourage these non-local hires to relocate permanently to the local area, with the principal focus being to relocate to the township of Blayney.

2.13 Decommissioning and rehabilitation

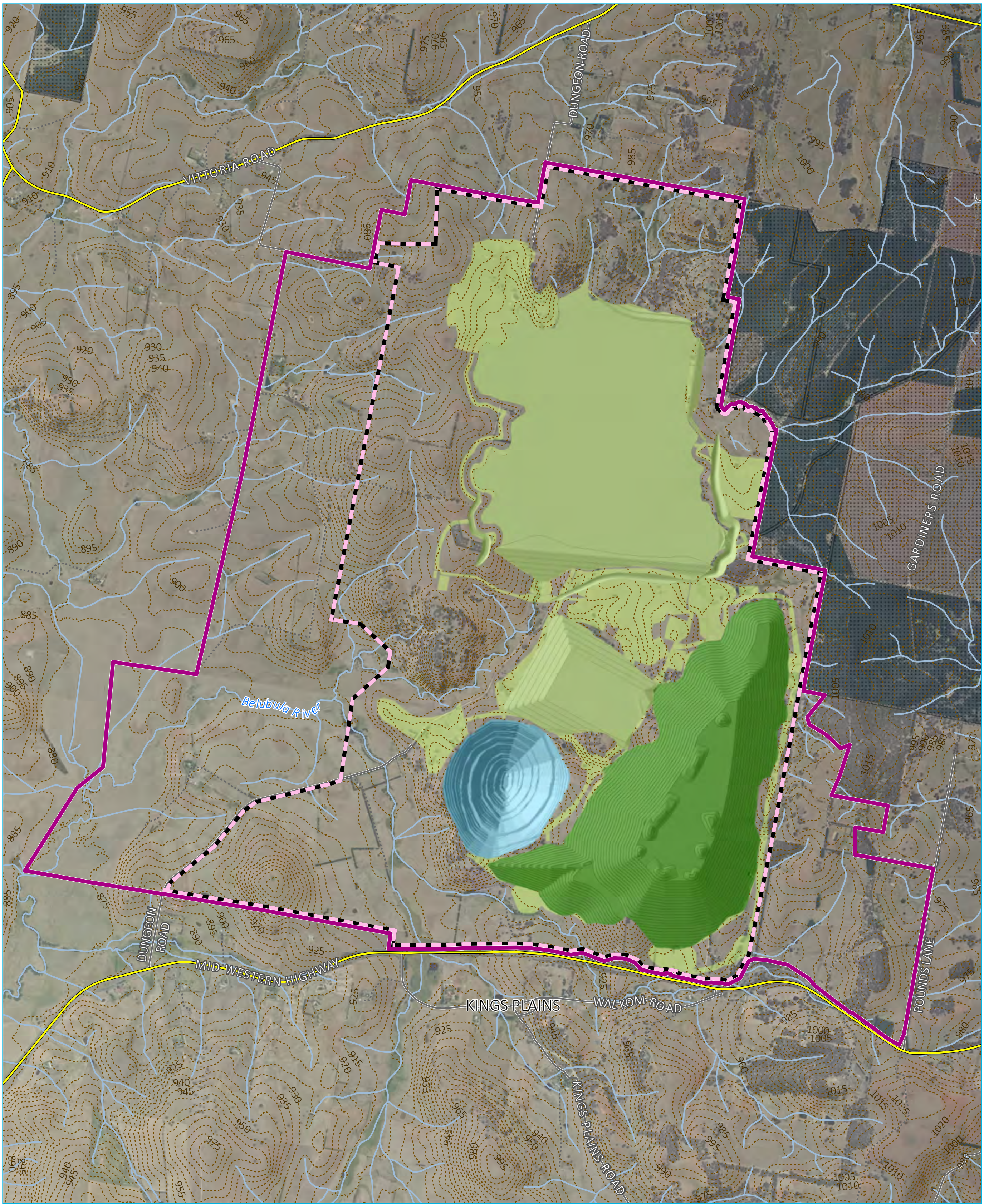
A Rehabilitation and Closure Strategy (EMMe 2019) has been prepared for the project and is contained in Appendix U. This strategy is summarised in Chapter 22.

The overarching rehabilitation objective of the project is to restore the land as much as possible to its pre-mining land use at the end of its operational life; that is, primarily an agricultural land use comprising grazing on improved pasture while improving the biodiversity values of the area through re-establishing endemic open-woodland communities as part of the rehabilitation program.

There will be opportunities for progressive rehabilitation of areas as the mine is developed, including the pit amenity bund and waste rock emplacement. Wherever possible during operations, disturbed areas no longer required for mining activities will be progressively rehabilitated.

Closure of the mine will involve rehabilitation of the remaining unrehabilitated sections of the waste rock emplacement, capping of the TSF, decommissioning and removal of infrastructure and services, soil testing of potentially contaminated areas such as ore stockpile areas and hydrocarbon storage areas, and remediation or removal of any contaminated soil if required. NAF waste rock for capping the TSF after closure will be sourced from the embankments of the secondary WMF, which will be decommissioned. Reshaping of disturbed areas will be undertaken where required to blend these surfaces into the surrounding topography. These areas will then be contour scarified and stockpiled topsoil and subsoil applied to promote establishment of species appropriate for the post-mine land use. A number of permanent clean water diversion drains will be constructed to allow a free-draining landform. A conceptual final landform of the fully rehabilitated mine development is illustrated in Figure 2.14.

Final rehabilitation and project closure requirements will ultimately be developed as part of a detailed closure plan, which will be produced within five years of closure in consideration of input from key government agencies and relevant stakeholders at the time.



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

KEY

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Existing contour (5 m)
- Vittoria State Forest

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Mine plan contour (2.5 m)

Conceptual final landform elements

- Rehabilitated area (grazing)
- Rehabilitated area (open woodland)
- Void

Conceptual final landform

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Figure 2.14

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2.14 Pipeline development

2.14.1 Overview

As described in Section 2.10, the mine development will require water for a variety of purposes including product processing. The purpose of the pipeline development is to convey process water which is surplus to the operational requirements of Centennial and EA to the McPhillamys Gold Mine to fulfil this water demand, in conjunction with other sources on site such as rainfall runoff and pit inflows.

The pipeline development is illustrated in a series of figures included in Appendix V. The key components include:

- a pipeline approximately 90 km in length, starting at Angus Place and finishing in the mine development project area;
- up to four pumping station facilities including water storage tanks;
- a pressure reducing system; and
- a control system.

This section provides a description of the pipeline development including:

- the water sources for the pipeline water supply;
- operating regime;
- water availability and security;
- approvals required and infrastructure responsibility;
- the pipeline corridor; and
- key pipeline components.

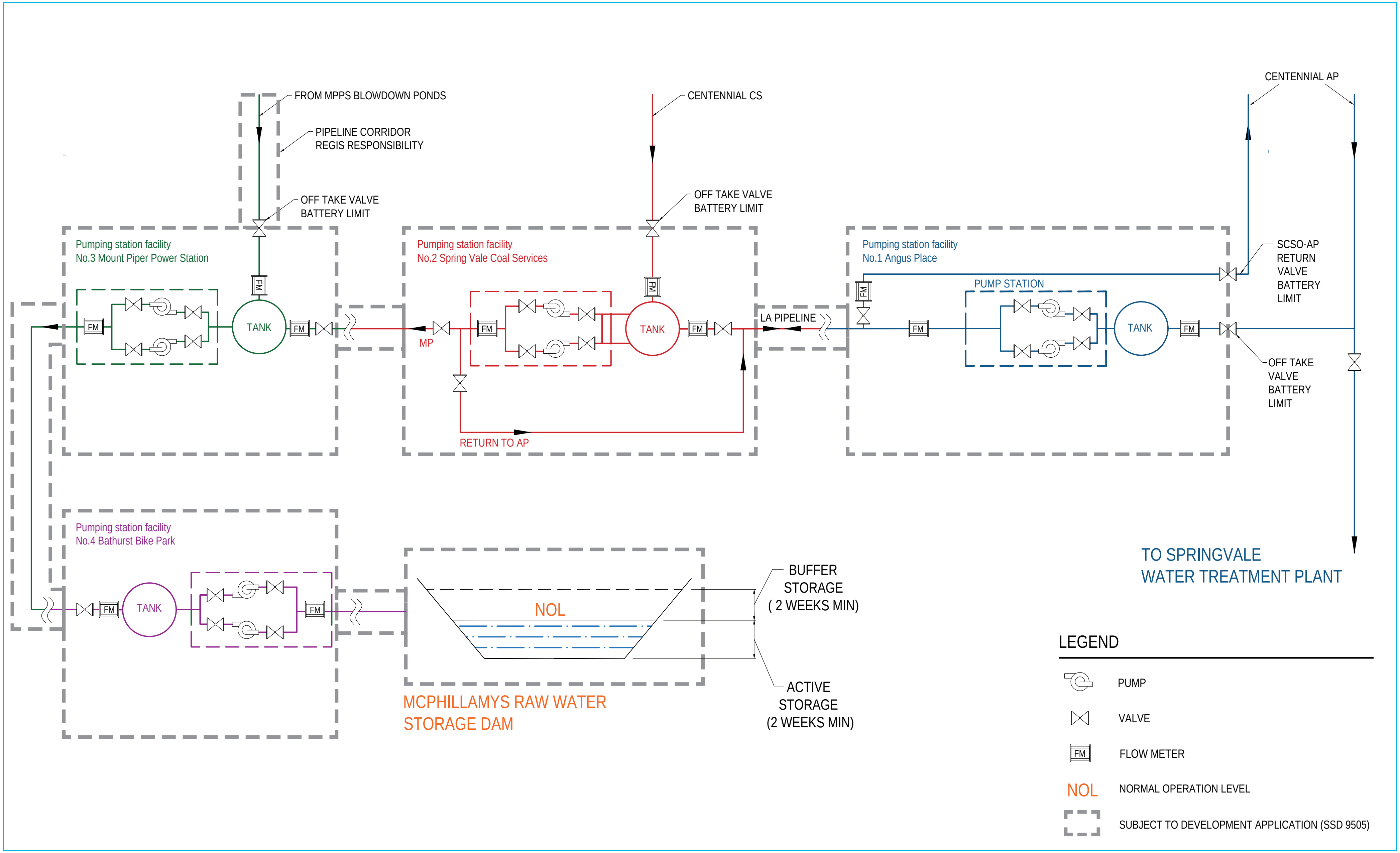
2.14.2 Water sources

The water to be pumped to the mine development via the pipeline will originate from the following three sources:

1. surplus groundwater at Angus Place which is currently discharged by Centennial into the Coxs River via licensed discharge point LDP001;
2. water at SCSO that is currently discharged by Centennial via licensed discharge point LDP006 into Wangcol Creek; and
3. water from the existing Blowdown Pond 1 (Blowdown Pond) at MPPS originating from the new Springvale water treatment plant (SSD 7592) and MPPS cooling towers. This water will be pumped from the existing Blowdown Pond at MPPS to the Regis pumping station facility No.3.

From each of these three sources, water will be pumped to storage tanks (approximately 750 kL) at each of the Regis pumping station facilities at Angus Place, SCSO, and MPPS.

A schematic illustration of the water transfer system between Angus Place, SCSO, MPPS and the mine project area is provided in Figure 2.15. The water quality parameters for the water are considered in Chapter 24.



Pipeline development operation schematic

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Figure 2.15

2.14.3 Operating regime

The pipeline development will:

- deliver on average 4,745 ML/year (around 13 ML/day) of water to the mine development;
- transfer water from Centennial's Angus Place and SCSO and EA's MPPS operations to the mine development continuously, apart from periods required for maintenance at the mine site or for pipeline maintenance requirements;
- discharge water into the raw water dam located at the mine site, which will have an overall capacity of approximately 400 ML or the equivalent of four weeks supply for mine operations;
- pump water over a period of 24 hours per day; and
- have a maximum transfer rate of up to 15.6 ML/day.

The pipeline development will be designed and operated so that water from any single source or a combination of the three sources is always capable of delivering up to 15.6 ML/day to the mine development. This flexibility will provide ongoing water availability for the mine development in periods of low rainfall, which will affect the availability of water at SCSO, or operational changes at MPPS.

The supply of water will be generally prioritised in the following order to provide 13 ML/day on average to the mine development:

1. SCSO;
2. MPPS; and
3. Angus Place.

The objective of this priority system is to eliminate discharge of untreated mine water from LDP 006 at SCSO which enters Wangcol Creek, a tributary of the Coxs River. On average between 1 to 3 ML/day of water is expected to be supplied by SCSO. However, during rainfall events, water supplied from SCSO may increase up to full supply.

When the water contribution from SCSO falls below 13 ML/day, then transfers from MPPS will be brought online with process water from the MPPS Blowdown Ponds transferred to the water storage tank at pumping station facility No.3 at the power station. Surplus groundwater from Angus Place will be used to supplement supply to a maximum of 15.6ML/day supply.

The McPhillamys water management system has been designed so that water runoff from disturbed areas within the mine development area will not discharge from the site consistent with regulatory requirements. To meet this objective the pipeline supply may be reduced or cease for some periods. Arrangements will be determined to vary supply in accordance with a pipeline operating protocol and the mine development water management plan. The protocol will provide for water collected at SCSO to be redirected to Angus Place where water collected at SCSO exceeds pipeline demand. Provision has been made for the transfer of excess water from SCSO to Angus Place via a bi-directional pipeline within pumping station facility No.2 (as shown in Figure 2.15). The excess water will then be transferred to pumping station facility No.1 at Angus Place. Centennial Coal will be responsible for any approvals required for water transfer from SCSO within Angus Place downstream of pumping station facility No. 1.

2.14.4 Water availability and security

i Rights to water

Rights to the above water sources will be authorised through the proposed Regis Resources Water Offtake Agreement (the agreement) with Centennial. The existing water access licences (WALs) held by Centennial and respective water sources relevant to the pipeline development are summarised in Table 2.8. As shown, the WALs are of varying sizes as a result of having been established due to progressive mining development.

Table 2.8 Water Access Licenses held by Centennial

WAL #	Sydney Basin Coxs River (ML/annum)	Sydney Basin (ML/annum)
36443	585	-
36446	3,300	-
36445	2,701	-
41881	1,471	-
37340	329	-
36383		5,958
36449		2,523
37343		35

ii Ongoing water availability

The ongoing operation of the mine development relies on the continued supply of water. The proposed water offtake agreement has been drafted with the intent of securing a reliable water supply to the McPhillamys Gold Mine. The McPhillamys raw water storage dam within the mine project area will have the capacity to store enough water to meet demand for up to two weeks in the event of a water supply interruption, such as a planned or unplanned shutdown, and an additional two weeks storage buffer could be transferred to provide up to four weeks supply (or 400 ML) in total.

2.14.5 Approvals required and infrastructure responsibility

The pipeline corridor, which is described in detail in the following section 2.14.6, defines the area over which approval is sought by Regis for the pipeline development. The interface at the start of the pipeline with Centennial operations and Energy Australia's MPPS is illustrated in the schematic in Figure 2.15. This figure illustrates the battery limit (the defined boundary of responsibility) of where Regis will hold responsibility for the pipeline infrastructure and where it will be the responsibility of Centennial or Energy Australia.

As shown in Figure 2.15, Regis will be responsible for obtaining the necessary approval for the required infrastructure on EA land including the transfer pipeline from the EA Blowdown Pond to pumping station facility No.3. The construction and operation of this infrastructure is therefore included in the pipeline development. EA will be responsible for the construction and operation of this infrastructure.

In addition to the development consent sought by Regis for the pipeline corridor, modifications to development consents held by Centennial will be also be required to enable the development. The modifications will be required for the:

- construction and operation of a water transfer pipeline and associated infrastructure between Angus Place and pumping station facility No.1 and between SCSO and pumping station facility No.2;
- the transfer of up to 15.6 ML/day of water from Angus Place or SCSO to the pumping station facilities No. 1 and 2 respectively; and
- the receipt of up to 15.6ML/day of water from SCSO to Angus Place Colliery as required at times when water is not able to be delivered to the McPhillamys mine project area according to the Agreement.

Modifications to the Angus Place and SCSO water management systems up to the respective Regis offtake valve are subject to separate modification applications by Centennial.

2.14.6 Pipeline corridor

The corridor will accommodate all components of the pipeline development including pumping station facilities and associated pipeline infrastructure as described in Section 1.1.7. The pipeline corridor also accommodates required construction ancillary areas such as compounds, laydown and stockpile areas as well as allowance for the movement of construction machinery, equipment delivery and personal vehicles along the corridor.

The corridor width varies from approximately 6 m up to approximately 20 m in width, excluding the four pumping stations facilities. At these facilities, the corridor width extends to an area of up to 75 m by 75 m to accommodate the construction and operation of these facilities. The width of the corridor has been carefully defined in consideration of property and environmental constraints. Where there are property constraints, such as the need to avoid an existing easement, or environmental constraints such as the presence of a listed endangered ecological community (EEC), the width of the corridor has been narrowed to avoid these constraints as far as practicable to a minimum width of 6 m. In areas where there are no identified constraints, the pipeline corridor is up to 20 m wide to allow the flexibility to refine the pipeline alignment during detailed design as well as to accommodate ancillary areas, such as construction compounds, during the construction phase.

The proposed route of the pipeline corridor is shown in Figures 2.2a to 2.2h, and is summarised from the beginning of the corridor at pumping station facility No.1 as follows:

- from pumping station facility No.1 at Angus Place, the pipeline will travel over land owned by Centennial and a private landholder, crossing the Coxs River south of the haul road owned by Coal-Link Pty Ltd, through land owned by EA and the Forestry Corporation of NSW, before crossing the Castlereagh Highway to pumping station facility No. 2 at SCSO;
- from pumping station facility No.2 at SCSO, the pipeline will continue over land owned by Centennial and Crown Land onto land owned by EA, to pumping station facility No.3, which will be at the south-eastern corner of the MPPS adjacent to Springvale's water treatment plant;
- from pumping station facility No.3 at MPPS, the pipeline will continue across land under the control of Centennial and owned by EA to Pipers Flat Road, before heading west to John Mackey Drive crossing Sunny Corner Road to Reservoir Road (south of Portland) and continuing west to Bourkes Road in Forestry Corporation NSW lands;
- in the Forestry Corporation of NSW lands the pipeline:
    - travels south-west along Sugarloaf Road, then north-east along Sunny Corner Road and south over Forestry tracks, before turning briefly west along Kelly Boundary Road and then south-west along Forestry tracks to Egan Road;

- continues west along Egan Road, before heading south and then south-west along Ridge Road, passing to the south of the Kirkconnell Correctional Centre;

- continues south along Sunny Corner Road, then west along a forestry track to Kirkconnell Forest Road then south on Macabees Road, turning immediately west along Phillips Boundary Road and south along Stoney Trig Road; and

- travels west along Gulf Boundary Road, before a short crossing over native forest, then south along Sibleys Road to the pressure reducing system until turning west along Yetholme Drive;

• leaving Forestry Corporation of NSW lands, the pipeline corridor continues west along the northern side of the Great Western Highway, before crossing the highway then heading south across privately owned farmland to the APA gas pipeline easement. From here, the corridor follows the APA gas pipeline easement across Brewongle Lane, before leaving the APA easement, and crossing the railway line just north of the town of Brewongle and then west along Tarana Road to the junction with O'Connell Road;

• continues north-west along (and crossing) O'Connell Road, then west across farmland tracks to Thompsons Hill Retreat, north along White Rock Road to the Macquarie River;

• under the Macquarie River and remerging on Montavella Road, south on Gormans Hill Road and then west along a fenceline, crossing Lagoon Road and Queen Charlottes Creek (Vale Creek), Vale Road and the rail line at Orton Park (south of Bathurst) to pumping station facility No.4 within the Bathurst Bike Park in the vicinity of the velodrome and Bathurst Waste Management Centre;

• from pumping station facility No.4, the corridor heads south-west over farmland, crossing Hen and Chicken Lane and south-west and west over farmland until crossing the Mid Western Highway at Bathampton; and

• across a scattered treed landscape until reaching Forestry Corporation of NSW lands to the north-west and along forest roads, crossing Gardiners Road before entering the eastern boundary of the mine project area.

The pipeline corridor also includes an ancillary corridor, approximately 1 km in length, which will accommodate a small pipeline required to transfer water from the Blowdown Pond at MPPS over land owned by EA to the pump station facility No.3 at MPPS. EA will be responsible for the construction and operation of this small pipeline.

2.14.7 Components

The components of the pipeline development are described in the following sub-sections. This description is based on a concept design for the pipeline development and as such will be subject to refinement during the detailed design and construction phases. These refinements may include minor changes to the proposed technology of the water supply pipeline or pumping station facilities, or minor changes of the alignment of the pipeline within the defined pipeline corridor.

i Water supply pipeline

The pipeline will have a nominal diameter of between 300 mm to 650 mm.

The majority of the pipeline will be laid underground in a trench ranging from 1.3 m to 2 m deep, with a minimum cover of 800 mm. Where underboring of roadways, rail lines or watercourses is required, the specific engineering design for that location will dictate the depth of the pipeline. The pipeline material will be confirmed during detailed design, but may be ductile iron, heavy duty polyethylene, steel or glass reinforced plastic, or a combination of these.

As described above in Section 2.5.2, an additional pipeline is required to transfer water from the MPPS Blowdown Pond to the pumping station facility No.3 (MPPS). This pipeline will be approximately 1 km in length and will also have a nominal diameter of between 300 mm to 650 mm.

Ancillary pipeline infrastructure is described in the following sub sections.

a Valves

Isolation, scour and air release valves will be located as required along the pipeline. Isolation or section valves will be provided to isolate the pipeline into discrete sections and allow only part of the whole pipeline to be dewatered for maintenance, or to provide security in an event such as a pipe burst. Isolation valves will also typically be installed on either side of main crossings, such as a watercourse crossing. Valves will be typically buried in the ground at the same depth as the pipeline and fitted with a spindle that rises to the surface which opens and closes the valve. The spindle will be enclosed in a small valve box. The valve box will be installed to be flush with the existing ground level.

Scour valves will be located at low points of the pipeline to facilitate maintenance and emergency drainage of the pipeline. Scour valves will be buried and fitted with a spindle and valve box flush with the existing ground level. The valves will discharge to a nominal 750 mm diameter scour pit. Scour pits will be approximately 1 to 3 m deep and finished flush with the existing ground level where possible.

Air release valves are designed to automatically release the small amounts of air that will accumulate in high points of the pipeline during operation. They will also discharge or admit air during the filling or draining process. Air release valves will be typically enclosed within 1.2 m^2 concrete pits with steel lids, and will be located below ground, finishing flush with the existing ground level.

Scour valves and air release valves will be installed approximately every 1 to 2 km as required by the prevailing topography. The final location and design of the respective valves will be determined during detailed design.

b Other pipeline infrastructure

Tapping points may be required along the pipeline for insertion of chlorine for maintenance or cleaning purposes. If required, cleaning (or 'pigging') stations will also be located as required along the pipeline. At the cleaning stations, which would be fabricated from concrete, cylindrical cleaning apparatus known as 'pigs' will be inserted into the pipeline during maintenance periods. Each cleaning station will be located below ground and will be approximately 5 m wide, 10 m long and 1 to 2 m deep. The requirement for tapping points or cleaning stations will be confirmed during detailed design.

Anchor or thrust blocks will be used as necessary to mitigate the hydraulic 'shock' which occurs when pumps commence or cease operation. This hydraulic effect could result in movement of the pipeline or breakage, particularly at sharp changes in direction, unless the pipeline is held in place securely.

ii Pumping station facilities

Four pumping station facilities will be required to ensure efficient transfer of water through the pipeline. They will be located at approximate chainages:

- pumping station facility No.1 (Angus Place) – chainage 0.0;
- pumping station facility No.2 (SCSO) – chainage 4250;
- pumping station facility No.3 (MPPS) – chainage 7200; and
- pumping station facility No.4 (Bathurst Bike Park) – chainage 65800.

Each pumping station facility will occupy a maximum area of approximately 0.56 ha or 75 m x 75 m with the exception of pumping station facility No.4 which will have a maximum area of approximately 35 m x 50 m or 0.17 ha. Pumping station facilities will be fenced for public safety and security purposes. Within each pumping station facility there will be the following:

- a water storage tank with a capacity of approximately 750 kL, approximate dimensions of 6 to 9 m high and diameter of between 11 m to 14 m. The tank will be constructed of concrete or steel;
- above ground and underground pipework and valving connecting to the water supply pipeline;
- monitoring and control equipment, including flow metres, tank level detection and automated valves;
- a pump and motor building, typically comprising electric motor and pump sets in a duty–standby configuration;
- a pad mounted power transformer and incoming high voltage electricity supply;
- a control room / electric switchroom housing:
  - supervisory control and data acquisition (SCADA) instrumentation for the remote control of the system;
  - high voltage circuit breakers;
  - low voltage switch gear;
  - variable voltage variable frequency drives for pump speed control;
  - fire suppression equipment; and
  - supervisory control and data acquisition equipment for remote control of the system;
- bunding and water collection systems (collection sump and pump) depending on the environmental requirements at the pump station location; and
- an access road and small parking area.

The buildings at each pumping station will be rectangular, single storey structures, fabricated from either tilt-up concrete, moulded concrete, block work or brick work, and will be fitted with a structural steel or concrete roof. The facility will have fencing and access gates (typically galvanised pipe posts and rails with chain mesh wire).

iii Pressure reducing system

In the vicinity of Sunny Corner (CH38500) a pressure reducing system will be installed to protect the pipeline from excessive pressure. It will comprise pressure reduction valves, a water storage tank, vents and electrical controls, as required in accordance with the detailed design. A pressure reducing system is typically enclosed in a building with noise mitigation measures depending on the noise attenuation requirements for the site. An additional pressure reduction system may be required further along the pipeline corridor depending on refinements made to the design and choice of materials, which will be determined during detailed design. Additional pressure reducing systems, if required, will be accommodated within the defined pipeline corridor.

iv Power supply infrastructure

Power required for the pipeline development, particularly the pumping station facilities and pressure reducing system, will be sourced from the relevant electricity network distributor; either Endeavour Energy or Essential Energy. Applications will be made to the distributor for the new network connections when the detailed power requirements are understood.

Assessment and approval for the power supply works will be subject to the requirements of Part 5 of the EP&A Act.

A summary of the power supply works to be undertaken include:

- Pumping station facility No.1 (Angus Place) – power supply will be required to connect the pumping station facility to the existing supply located 300-400 m away on the western side of Wolgan Valley Road.

- Pumping station facility No.2 (SCSO) – new power supply will be required to connect the pumping station facility to the existing supply located 150-250 m away on the north-eastern side of the Castlereagh Highway.

- Pumping station facility No.3 (MPPS) – power supply to this pumping station facility will be determined during detailed design.

- Pressure reducing system (PRS) – power supply to this pressure reducing system will be determined during detailed design.

- Pumping station facility No.4 (Bathurst Bike Path) – new power supply will be required to connect the pumping station facility to the existing supply located 250-350 m away in the Bathurst Waste Management Centre.

v Communications System

An end to end communications system will be required to control the operation of the pumps and pressure reducing system. The communications system will either be a fibre optic system, a radio telemetry or 4G mobile connection or a combination of these. A fibre optic cable system will be installed in the same trench as the pipeline to connect each pumping station facility and pressure reducing system to the control centre at the mine site. If it can be demonstrated that a radio telemetry system or 4G mobile network connection can be provide the required reliability a system comprising one or both of these may be implemented instead. These systems will require the construction of a small mast and antenna at each pumping station and the pressure reducing system.

2.15 Pipeline development construction

2.15.1 Overview

This section provides a description of the pipeline development construction including:

- construction methodology, comprising:
    - trenched pipeline installation;
    - underboring pipeline installation;

- pumping station facilities and pressure reducing system;

- construction timing and staging;
- construction workforce;
- proposed construction traffic access arrangements;
- construction equipment;
- utility adjustments; and
- pipeline commissioning.

2.15.2 Construction methodology

i Pipeline trenching - construction methodology

The indicative construction sequence for installation of the pipeline will involve:

- consultation with landowners regarding access;
- establishing site environmental controls;
- erecting temporary stock fences where required;
- creating temporary access tracks where required;
- clearing vegetation and removing and stockpiling topsoil;
- trench excavation;
- stringing of pipes along route;
- placing bedding material;
- installing pipework;
- casting and pouring of concrete thrust blocks;
- installing valves (e.g. scour valves and pits, air valves and pits);
- backfilling the trench; and
- site restoration.

It is anticipated that the majority of the pipeline will be constructed using open trenching techniques. However, rail crossings and some road and watercourse crossings will be undertaken using underboring. The typical trench will be approximately 1 m wide and ranging from 1.3 m to 2 m deep with a minimum cover of 800 mm.

The area that will be directly impacted by construction activities within the pipeline corridor will range in width from 6 m, such as along forestry tracks, to 20 m in open farmland, depending on a range of factors such as presence of significant vegetation, constructability, construction management and safety considerations, landform, slopes and anticipated sub-soil structures. The final disturbance zone, within the pipeline corridor, will be confirmed during detailed design.

Erosion and sediment controls will be installed and maintained prior to the start of construction activities in accordance with the *NSW Soils and Construction – Managing Urban Stormwater Volume 1 "the Blue Book"* (Landcom 2004) and *Volume 2* (DECC 2008).

Clearing and grading will be minimised where practicable to the extent necessary for construction of the pipeline and ancillary infrastructure and will not exceed the pipeline corridor. Topsoil and other obstacles such as rocks will be removed with a bulldozer, motor grader or excavator. The trench will then be excavated using a tracked excavator, backhoe, tracked chain trencher or other similar mechanical equipment. Where rock is encountered, hydraulic breaking and/or blasting may be required. Topsoil and spoil will be stockpiled adjacent to the excavated trench.

Pipe sections will be stockpiled within the pipeline corridor approximately 2 to 4 km apart adjacent to an existing road or access which will be suitable for a semi-trailer or truck access. The pipes will be transported along the corridor and strung out along the edge of the proposed trench alignment. Regis has obtained NSW Forestry's permission to use existing disturbed areas within NSW Forestry lands as construction ancillary areas such as material and equipment laydown areas.

Pipeline construction will be a progressive operation with a number of work fronts potentially being constructed concurrently. The trenching rate will be variable depending upon ground conditions and machinery used. In rocky conditions, for example on forestry tracks through Sunny Corner State Forest, the trenching rate will be around 40-80 m/day, compared to open farmland where the rate may be 600 – 650 m per day. Trench excavation, pipe installation and backfilling will generally occur within the same day for pipe laying and backfilling of the open trench within the same day. Appropriate construction techniques and safety controls will be utilised, including safety barriers, as required, for open trenches.

Once a trench has been excavated, granular bedding material will be placed in the base of the trench by an excavator (or similar plant) and levelled. The pipeline segments will then be lowered into the trench. Where ductile iron or steel pipes are used, a plastic sleeve may be wrapped around the pipe to provide corrosion protection. Each pipe segment will then be joined to the pipeline. Valves and concrete thrust blocks will then be installed as required.

Once the pipe has been laid and joined, backfill will be placed around the pipe with an excavator (or similar plant) and compacted, typically with a hand-held vibrating plate compactor. Backfill material will comprise a combination of excavated trench material (depending on condition) and imported fill.

Imported fill will be delivered to site via a tipping truck. Excess excavated material unsuitable for use as backfill will be removed from the site to a suitable landfill via a tipping truck.

Tipping trucks (for spoil movement) and flatbed trucks (for movement of pipes and equipment) will shuttle between the stockpiles and pipeline construction sites. The trucks will be loaded by an excavator (or similar plant). Bulk supplies of material will be delivered to the stockpile sites via semi- trailer.

Site rehabilitation will be undertaken progressively following construction. Typical rehabilitation activities will include spreading topsoil and revegetation. In some areas, tree replacement will be undertaken.

ii Trenchless technology - construction methodology

Underboring (such as horizontal directional drilling or micro-tunnelling) will be employed for three rail, six road, two watercourses and under a stretch of protected native vegetation as follows:

- Castlereagh Highway;

- Pipers Flat Road
- Mid-Western Highway;
- Great Western Highway;
- O'Connell Road;
- Vale Road;
- Wallerawang Gwabegar Railway Line;
- Main Western Railway Line (two crossings);
- Macquarie River;
- Queen Charlottes Creek; and
- Biodiversity offset site – Energy Australia land.

Horizontal directional drilling (HDD) will generally involve the following activities:

- Excavation of drill launch site and drill reception site (approximately 6 m x 6 m). The drill launch site will contain the drilling rig and a control room. Launch and reception pits will also capture drilling mud prior to solids removal and reuse.
- Drilling of a pilot hole by a rotating, remotely-controlled drilling head attached to hollow drilling rods. The rotating and steerable drill will be launched from the surface or a shallow excavation at the drill launch site. The drill launch site will be preferably at the downstream end of the proposed drill line.
- Water, a drilling fluid, or drilling mud, will be used to lubricate the drilling head and flush the drilled hole. Drill cuttings are removed in the drilling fluid or drilling mud, which travels down the hollow drilling rod string back to the drill launch site where it is contained, collected and passed through sets of screens and liquid cyclones to remove the abrasive drill cuttings so that the "mud" can be recirculated. The mud cleaning and recycling plant will be self-contained and powered by an onsite generator.
- Reaming (ie enlarging) the pilot hole by attaching a back reamer or forward reamer to the string of rods will be used to progressively enlarge the pilot hole.
- When the required diameter of the hole is reached, the new pipe will be attached to the string of drill rods and pulled through the hole.
- The annulus surrounding the installed liner pipe is back grouted at each entrance.

A typical underboring installation will take approximately three weeks. Underboring crossings in more sensitive locations such as the Macquarie River will take approximately four to six weeks.

iii Trenched crossings - construction methodology

a Road crossings

Road crossings, with the exception of highways, will be undertaken using open trenching techniques. Trenching will be undertaken in two stages with trenching and backfilling of half the road width, and then completion of the remaining half of the road crossing. Traffic movements in a single lane will be maintained in accordance with traffic management and traffic control plans.

Pipeline construction and rehabilitation within road reserves will be undertaken in accordance with the requirements of the relevant road authority.

A typical crossing using this method will take approximately two to four days.

b Waterways

During construction, 112 creeks and drainage lines will be crossed. Most of these are minor streams and gullies which are ephemeral and only flow after large rainfall events. Nine crossings will be associated with permanent watercourses as follows (from east to west):

- Coxs River;
- Wangcol Creek;
- Pipers Flat Creek;
- Salt Water Creek (two crossings);
- Macquarie River;
- Queen Charlottes Creek (Vale Creek);
- Evans Plains Creek; and
- McLeans Creek.

It is noted that mine discharge water from Angus Place contributes to flow in the Coxs River at the location where the pipeline corridor will cross. Discharges from Angus Place to the Coxs River will cease by 31 December 2019, after which this portion of the Coxs River is expected to experience lower flows.

Regis proposes to cross the above watercourses via open trenching, with the exception of the Macquarie River, Queen Charlottes Creek, which will be under bored and Wangcol Creek where the pipeline will be fixed to the existing causeway.

Watercourse trenched crossings will be scheduled as far as practicable to occur during drier low flow conditions. Coffer dams will be used, as required, to enable trenching of these watercourses. The coffer dams will be sized to provide sufficient water storage to allow the trench to be excavated, the pipeline to be laid and the protective concrete encasement to be placed. If the flow rate and gradient of the creek is such that insufficient storage volume is available, a bypass pumping system around the dam may be established.

A typical crossing using this method will take approximately two to four days.

c Gas pipeline crossings

The pipeline will cross the APA gas pipeline at several locations, as shown in figures 2.2a to 2.2h. Construction methodology for these crossings will meet APA's strict safety requirements and will generally be carried out by trenching methodology with a combination of hand tools and conventional trenching machinery used. Each crossing will take up to three days.

iv Pumping station facilities and pressure reducing system - construction methodology

The indicative construction sequence will involve:

- establishing site environmental controls;
- clearing vegetation and removing and stockpiling topsoil;
- site grading;
- site establishment (site sheds, amenities and stores);
- constructing hard stand areas where required (typically road base);
- excavating for footings and foundations;
- installing footings and foundations;
- erecting structures, tanks and pipework;
- installing mechanical and electrical equipment;
- mechanical, electrical and hydraulic commissioning; and
- construction site demobilisation and restoration.

The construction footprint for pumping station facilities No.1, No. 2 and No.3 will be a maximum of 75 x 75 m or 0.56 ha while the construction footprint of pumping station facility No.4 has been limited 50 m x 35 m or 0.17 ha to minimise impact on native vegetation as far as practicable. The construction footprint for the pressure reducing system will be approximately 0.04 ha. Within these construction footprints, clearing and grading will be minimised where practicable to the extent necessary for construction. The final construction site footprint will be determined in consultation with the contractor.

v Construction compounds

Construction compounds will be placed predominately within the pipeline corridor. Regis has obtained permission from the Forestry Corporation to use existing disturbed areas within NSW Forestry lands in the vicinity of the pipeline corridor as construction compounds.

The mobile work fronts will be supported by secondary stockpiling sites, approximately every 2 to 4 km along the pipeline route. These sites will be used as staging areas for the laying down of bulk supplies of pipe work, bedding material and possible excess backfill to be transported to an approved landfill site. They are likely to be provided with a portable toilet, small demountable site shed and one or two shipping containers for storage.

2.15.3 Construction duration and hours

Construction is estimated to take approximately 12 months, subject to arrangements made between Regis and the contractor. It is anticipated that construction will commence upon the required approvals being obtained.

Standard construction hours will be from 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm on Saturdays, although some out of hours works may be required at the request of Roads and Maritime Services, the NSW Police (ie trenched road crossings) or property owners to minimise specific impacts. Any variations to the nominated construction hours will be communicated to relevant neighbouring land owners.

2.15.4 Workforce

Construction activities will be carried out by a workforce of approximately 120 full-time equivalent employees during peak periods.

It is anticipated that two to four crews will be involved in the pipeline construction. A further two crews will be working on the pumping station facilities, and a separate construction crew will be responsible for underboring works.

2.15.5 Construction access

The pipeline development will require access agreements along the pipeline corridor prior to the commencement of construction activities to enable the necessary surveys and construction works to be undertaken. Permissions from easement holders of existing services will be obtained for traversing public and private easements and land.

Access to the proposed pipeline corridor will be via various routes, including public roads and State Forest tracks and private lands including within Angus Place, SCSO and MPPS. Any fencing taken down to permit access to the corridor will be replaced with a gate, in consultation with the landholder. Individual property management plans will be developed in consultation with individual landowners with respect to property access arrangements and rehabilitation of the construction corridor.

Further detail regarding site access is provided in Chapter 30 (traffic and transport).

2.15.6 Construction equipment

An indicative equipment fleet to be used during construction is as follows:

- 20 t excavator for pipe laying and backfilling;
- 30 t excavator with impact hammer (for rock breaking);
- jack hammer (for rock breaking);
- track trencher (Vermeer T855);
- vibrating plate compactor;
- concrete mixer;
- horizontal directional drilling rig; and
- drilling mud plant.

Ancillary equipment will also be required including (but not limited to) petrol pumps, welders, generators, hand tools, delivery and light vehicles.

2.15.7 Utility adjustments

Consultation with utility authorities has been carried out as part of the development of the concept design for the pipeline development to identify and locate existing services. Should existing services need to be relocated, work will be undertaken in consultation with the relevant service providers. The pipeline corridor has been defined to accommodate service relocations as required within the corridor.

2.15.8 Pipeline commissioning

During commissioning, the pipeline will be pressure tested and monitored for any leaks. Emptying of the pipeline will occur at scour valves located at intermediate low points along the alignment, and water will be removed via suction tanker truck and taken to the mine site or to an appropriately licensed wastewater treatment facility such as Bathurst Council's sewage treatment plant.

2.15.9 Rehabilitation

Practical and achievable rehabilitation objectives will be agreed with each landowner. Agreed rehabilitation requirements for individual properties will be incorporated into property management plans, which will be developed prior to construction starting on the relevant property.

One of the primary aims of rehabilitation activities will be to rapidly stabilise disturbed areas. The reinstatement of disturbed areas will take place as soon as possible after construction has been completed. These activities will include:

- reinstatement or replacement of gates and fences;
- spreading topsoil and ground cover seeding;
- treatment of new ground cover to retain moisture and accelerate regrowth;
- installing sediment and erosion control measures to provide an optimal environment for regrowth;
- return of all disturbed land, waterways and riparian zones to a stable condition; and
- ongoing monitoring and approval of rapid reinstatement work by the environmental representative and project manager.

Following stabilisation of disturbed areas, rehabilitation activities will focus on the establishment of a permanent cover of vegetation that reflects the:

- original vegetation;
- findings and recommendations of the terrestrial ecology assessment; and
- requirements of maintaining an ongoing easement (for land subject to the easement).

Rehabilitation will initially be managed by the construction/restoration contractor, with sign off and handover to Regis at an appropriate time (around one to two years after construction). Regis will continue to monitor the construction corridor and if issues arise will take action in consultation with the landowner. Further discussion on rehabilitation is provided in Chapter 35.

2.16 Pipeline development maintenance and decommissioning

2.16.1 Overview

This section describes the maintenance and decommissioning of the pipeline development. It also describes the creation the pipeline easement. An overview of the operating regime of the pipeline is provided in Section 2.14.3 above.

2.16.2 Maintenance

During the operational phase, Regis will periodically inspect the pipeline development, undertaking routine and planned maintenance to ensure that the pipeline is functioning adequately. This will include maintenance of the pumping stations, pressure reducing system and valves.

Fault detection systems will be incorporated within the pipeline design. If a pipeline leak occurs, the fault detection systems will shut down the water transfer and notify the operator that an inspection of the system is required. The maintenance team will undertake any repairs and will remain in the cleared pipeline easement to avoid disturbance to the natural environment.

Operation (opening) of the scour valves will allow dewatering of the pipeline for emergency repairs and maintenance. Dewatering will involve release of water to scour pits via the scour valves. Scour water will be transferred from the pits via a suction tanker truck and taken to the mine site or to an appropriately licensed wastewater treatment facility such as Bathurst Council's sewage treatment plant, or pumped to the nearest pumping station or the next appropriate pipeline section.

Cleaning stations may be required to facilitate cleaning of the pipeline during operations. If required, water from this cleaning process will contain chlorine and material scoured from the wall of the pipe. As described above, water will be transferred from the scour pits via a suction tanker truck to the mine site or to an appropriately licensed wastewater treatment facility.

2.16.3 Decommissioning

It is anticipated that the pipeline will remain in the ground at the end of the mine operating period. There may be an opportunity for the pipeline infrastructure to continue to provide future public benefit by enhancing water security and supply to the region, subject to obtaining the necessary approvals. At the end of the mine life, the pipeline development will be prepared for long term (mothball) shutdown. The above ground components will be removed, if after a reasonable time period, no additional users for the water or pipeline are identified.

Further discussion on rehabilitation of the pipeline corridor is provided in Chapter 35.

2.16.4 Easement

The final easement will be confirmed during detailed design. It is likely that the final easement will be, on average, 6 to 10 m wide. However, the easement may need to be wider in some areas, depending on the location, local conditions, and the presence of other infrastructure. The easement will remain as a cleared landscape to facilitate maintenance during the operational phase.

During operation, usage restrictions will apply to private land within the easement to protect the pipeline development. These restrictions will be included in the easement agreement entered into between Regis and landowners. Acquisition and compensation payable will be consistent with *the Land Acquisition (Just Terms Compensation) Act 1991.*

Part B

Legislative context and stakeholder engagement

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Chapter 3

Legislation and policy

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3 Legislation and policy

3.1 Introduction

This section describes the relevant Commonwealth and NSW regulatory and policy framework under which the McPhillamys Gold Project will be assessed and determined.

Two principal approvals are required for the project. The first is an SSD consent under Division 4.7 of Part 4 of the NSW EP&A Act. The approval process under Part 4 of the EP&A Act is described below in Section 3.2. Pursuant to section 4.42 of the EP&A Act, a number of approvals must be granted for approved SSD on terms substantially consistent with the SSD consent (refer to Section 3.3). Further, section 4.41 of the EP&A Act lists approvals under other NSW legislation that are not required for approved SSD, which are also discussed below in Section 3.4.

The second approval is an approval under the Commonwealth EPBC Act, as discussed in Section 3.7.

3.2 NSW Environmental Planning and Assessment Act 1979

3.2.1 Overview

The EP&A Act and the EP&A Regulation form the statutory framework for planning approval and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Public Spaces, statutory authorities and local councils. It contains two parts that impose requirements for planning approval:

- Part 4, which provides for control of 'development' that requires development consent from the relevant consent authority. A division of Part 4 (Division 4.7) provides for control of SSD. As noted above in Section 3.1, approval for the project is required under Part 4 of the Act.

- Part 5, which provides for control of 'activities' that do not require approval or development consent under Part 4. Approval for the required power supply for the project will be sought separately under Part 5 of the Act.

The requirement for development consent is set out in environmental planning instruments (EPIs), being State Environmental Planning Policies (SEPPs) or local environmental plans (LEPs).

3.2.2 State significant development

i SSD provisions

Part 4, Division 4.7 of the EP&A Act specifically relates to the assessment of SSD. Under Section 4.36 of the EP&A Act, a development is SSD if it is declared to be as such by any SEPP. The relevant SEPP to the project is the *State Environmental Planning Policy (State and Regional Development) 2011* (the SRD SEPP). In relation to SSD, Clause 8(1) of the SRD SEPP states the following:

> **8 Declaration of State significant development: Section 4.36**
>
> (1) Development is declared to be State significant development for the purposes of the Act if:
>
> a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and
>
> b) the development is specified in Schedule 1 or 2.

Clause 5(1) of the SRD SEPP states:

5 Mining

(1) Development for the purpose of mining that:

(a) is coal or mineral sands mining, or

(b) is in an environmentally sensitive area of State significance, or

(c) has a capital investment value of more than $30 million.

…

(3) Development for the purpose of mining related works (including primary processing plants or facilities for storage, loading or transporting any mineral, ore or waste material) that:

(a) is ancillary to or an extension of another State significant development project, or

(b) has a capital investment value of more than $30 million.

…

The project is development for the purpose of mining that has a capital investment value of more than $30 million. The estimated capital investment value of the project is $418 million.

Accordingly, the project is SSD and will be subject to the provisions of Division 4.7 of Part 4 of the EP&A Act.

ii Consent authority

Under Section 4.5(a) of the EP&A Act, the Independent Planning Commission (IPC) is the consent authority for SSD if the development is of a kind for which the IPC is declared the consent authority by an environmental planning instrument. The Minister for Planning is the consent authority if the development is not of that kind. Pursuant to Clause 8A(1) of the SRD SEPP, the IPC is declared to be the consent authority for the following types of SSD (unless the application to carry out the development is made by or on behalf of a public authority or the development is declared to be State significant infrastructure; neither of which is the case for the project):

(a) development in respect of which the council of the area in which the development is to be carried out has duly made a submission by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act,

(b) development in respect of which at least 25 persons (other than a council) have duly made submissions by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act,

(c) development the subject of a development application made by a person who has disclosed a reportable political donation under section 10.4 to the Act in connection with the development application.

Accordingly, if any of the above clauses are met, the project will be determined by the IPC; otherwise the Minister for Planning and Public Spaces will be the consent authority.

iii Development application

A development application (DA) for SSD must be accompanied by an EIS in accordance with Section 4.12 of the EP&A Act and the EIS must be prepared in accordance with Schedule 2 of the EP&A Regulation. Before preparing an EIS, an applicant must request DPIE's environmental assessment requirements (EARs) of the Secretary of DPIE, which specify the issues to be addressed in the EIS. The EARs for the project were initially issued by the DPIE on 24 August 2018 and revised EARs were issued on 19 December 2018. The mine development was also declared a controlled action on 28 May 2019 by a delegate of the Commonwealth Minister (refer to Appendix C). Accordingly, the Secretary of DPIE issued supplementary EARs to address matters of national environmental significance relevant to the mine development on 30 May 2019.

The EARs and where they have been addressed in this EIS are provided in Section 1.4 and Appendix B. The supplementary EARs as well as additional government agency assessment requirements from relevant statutory authorities are also provided in Appendix B, along with a table outlining where each requirement has been met in the EIS.

The relevant factors to be considered in the assessment and determination of the project are addressed in the sub-sections below.

3.2.3 Permissibility

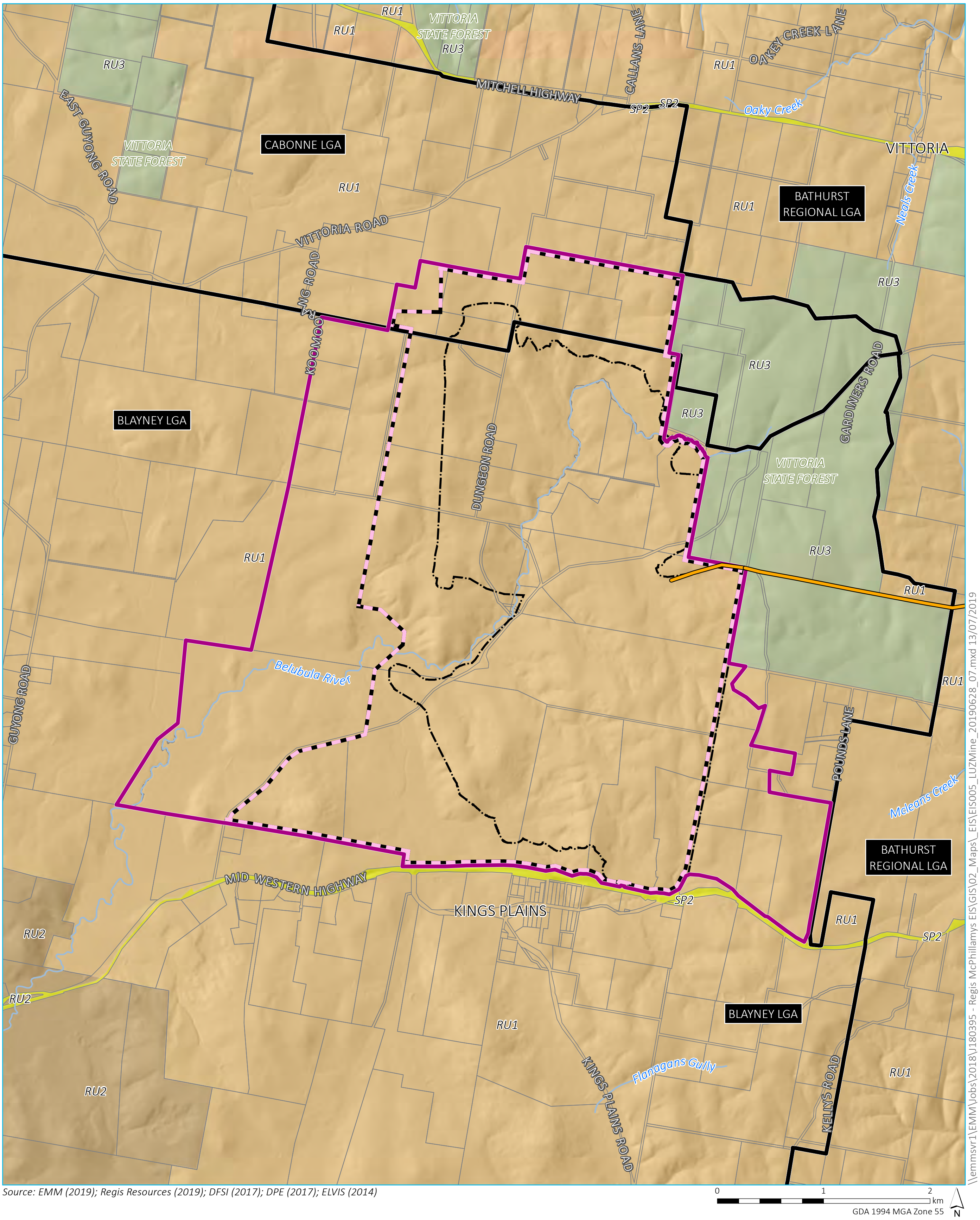
i Mine development

Pursuant to the *Blayney Local Environmental Plan 2012* (Blayney LEP) and the *Cabonne Local Environmental Plan 2012* (Cabonne LEP), the mine project area is on land zoned RU1 Primary Production, as shown in Figure 3.1. Development for the purpose of open cut mining is permitted with development consent in this zone under the Blayney and Cabonne LEPs.

Permissibility of mining developments is also governed by the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP), which prevails to the extent of any inconsistency with a LEP. Clause 7 of the Mining SEPP provides for development that is permissible with consent. Clause 7(1) of the Mining SEPP states the following:

> Mining
>
> Development for any of the following purposes may be carried out only with development consent:
>
> (a) underground mining carried out on any land,
>
> (b) mining carried out:
>
> i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or
>
> ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the *Mining Act 1992* or a mining licence under the *Offshore Minerals Act 1999*,
>
> ...
>
> (d) facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out (with or without development consent), but only if they were mined from that land or adjoining land…

Accordingly, the project is permissible with consent under both the LEPs and the Mining SEPP.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPE (2017); ELVIS (2014)

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint
- Named watercourse
- Cadastral boundary
- Local government area boundary

Land use zones

- RU1 Primary Production
- RU2 Rural Landscape
- RU3 Forestry
- SP2 Infrastructure

Land use zones in the mine project area

McPhillamys Gold Project
Environmental impact statement
Figure 3.1

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ii Pipeline corridor

The pipeline corridor traverses the Lithgow, Bathurst and Blayney LGAs. Pursuant to the Blayney LEP, the *Bathurst Regional Local Environmental Plan 2014* (Bathurst Regional LEP) and the *Lithgow Local Environmental Plan 2014* (Lithgow LEP), the pipeline corridor is on land zoned:

- RU1 – Primary Production (Lithgow, Bathurst and Blayney LEPs);
- SP2 – Electricity generating works (Lithgow LEP);
- SP2 – Roads and Traffic (Lithgow and Bathurst LEPs);
- RU3 – Forestry (Lithgow, Bathurst and Blayney LEPs);
- RU4 – Primary production small lots (Bathurst LEP); and
- R5 – Large lot residential (Lithgow LEP).

Under the respective LEPs, mining (and therefore works within the pipeline corridor) is permissible with development consent within some, but not all, of the above land use zones.

Open cut mining is permissible with development consent within the RU1 zone in accordance with the Blayney LEP. Mining is prohibited in the RU3 zone in the Blayney LGA.

The Bathurst LEP also provides for open cut mining to be permissible with development consent within the RU1 zone. Mining is permissible in the RU4 zone, but is prohibited in the SP2 and RU3 land use zones in the Bathurst LGA.

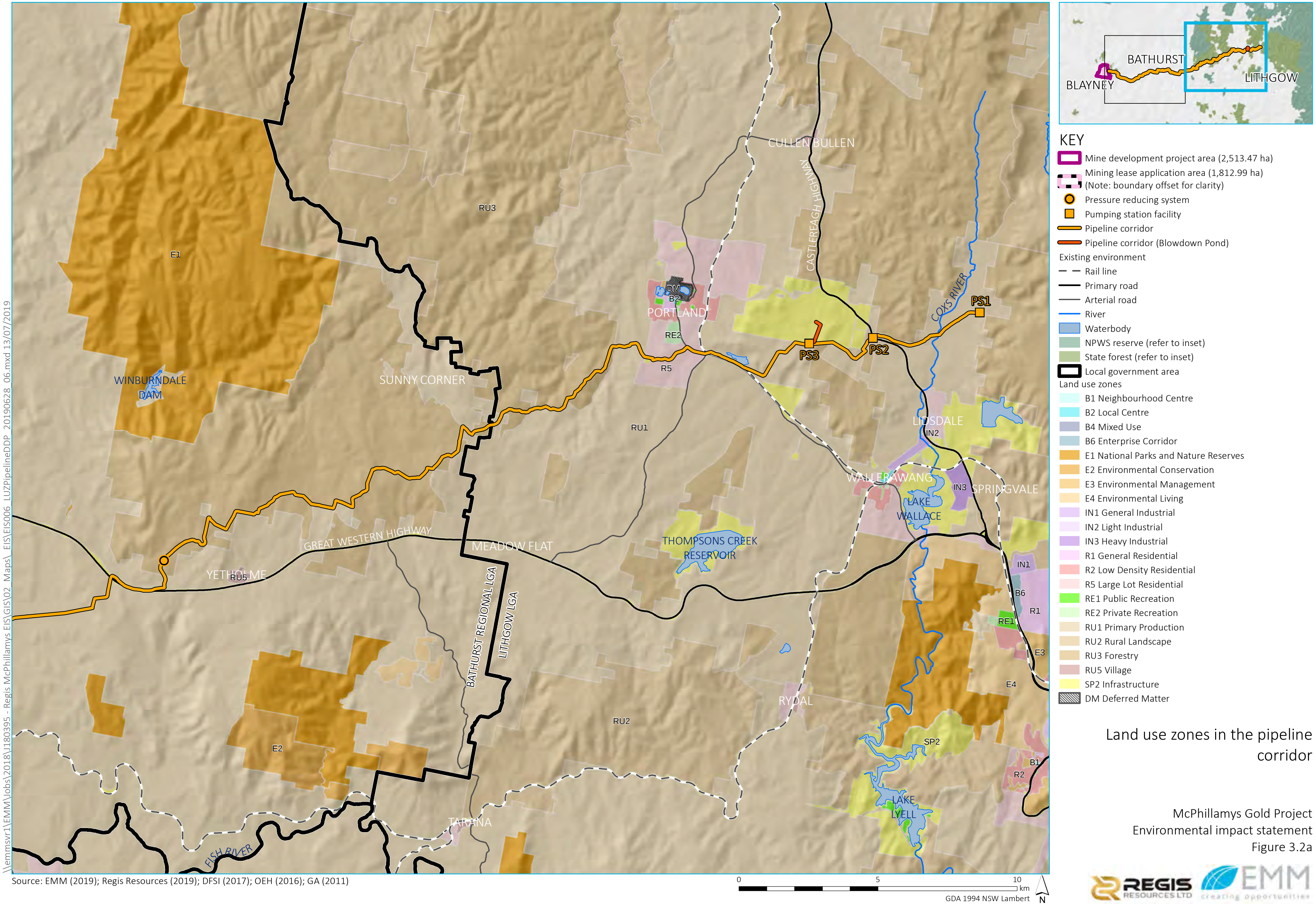
Pursuant to the Lithgow LEP, open cut mining is permissible with development consent within the RU1 and RU3 land use zones. Mining is prohibited in the SP2 zone and R5 zone.

As outlined above, the Mining SEPP provides that mining may be carried out with development consent on land where development for the purpose of agriculture or industry may be carried out. Accordingly, mining (and therefore works within the pipeline corridor) is permissible on land zoned RU1 in the Lithgow, Bathurst and Blayney LGAs. Open cut mining is permissible in the RU3 zone (Lithgow LEP), and mining is permissible in the RU4 zone (Bathurst LEP); however, is prohibited in the RU3 zone within the Blayney and Bathurst LGAs, and land zoned as SP2 in all LGAs.

Whilst the pipeline development is prohibited in some land use zones, it is not necessary for the project to be wholly permissible under relevant environmental planning instruments in order to be the subject of a lawfully granted development consent. This is because, in relation to SSD, Section 4.38 (3) of the EP&A Act states:

> Development consent may be granted despite the development being partly prohibited by an environmental planning instrument.

The land use zones in the pipeline corridor are illustrated in Figure 3.2.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2016); GA (2011)

Land use zones in the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 3.2a

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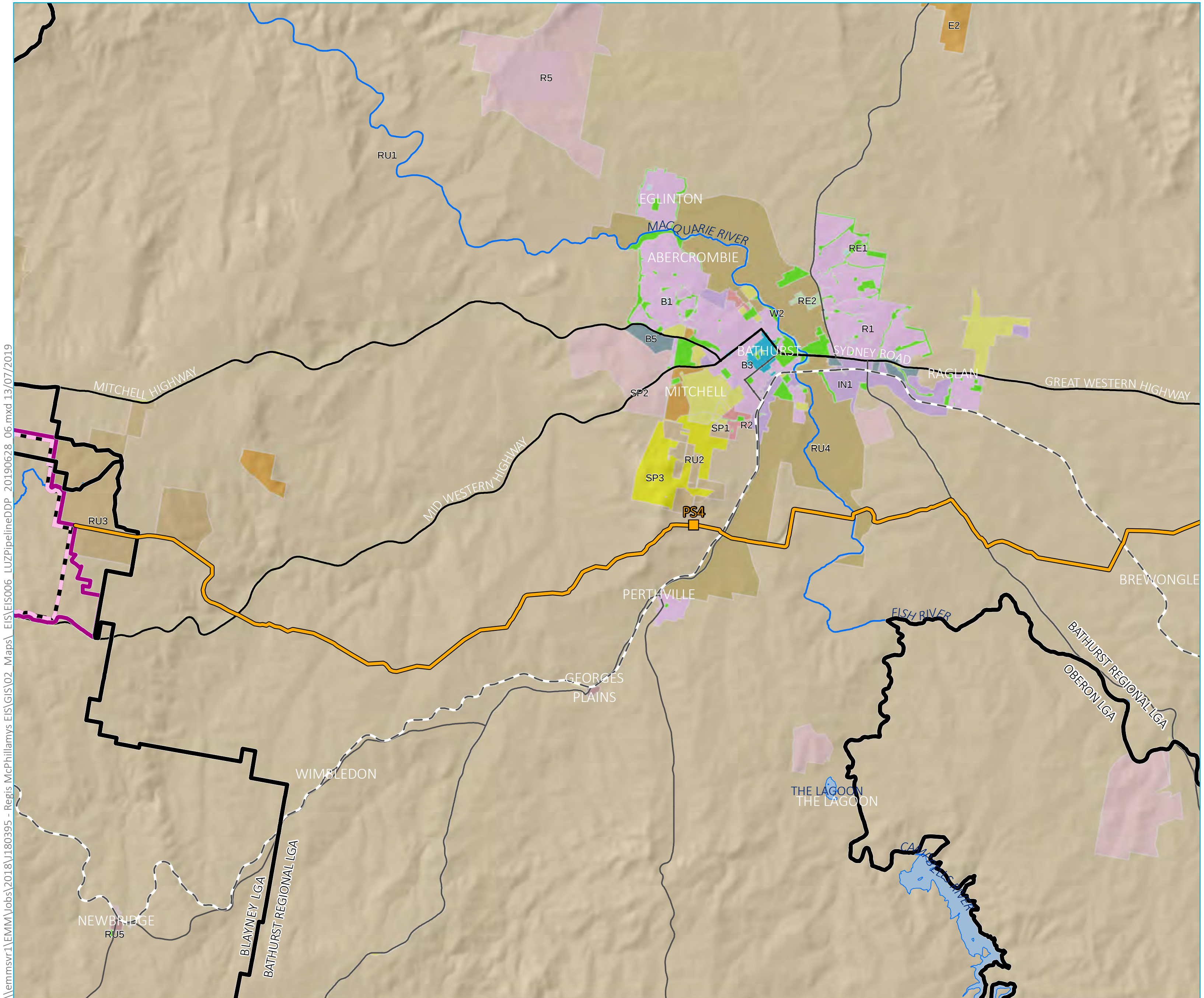

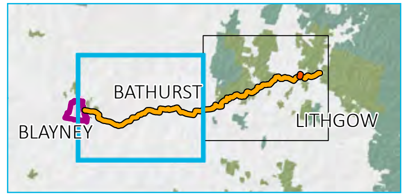

KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)
- Local government area

Land use zones

- B1 Neighbourhood Centre
- B3 Commercial Core
- B5 Business Development
- E2 Environmental Conservation
- IN1 General Industrial
- R1 General Residential
- R2 Low Density Residential
- R5 Large Lot Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU1 Primary Production
- RU2 Rural Landscape
- RU3 Forestry
- RU4 Primary Production Small Lots
- RU5 Village
- SP1 Special Activities
- SP2 Infrastructure
- SP3 Tourist
- W2 Recreational Waterways

Land use zones in the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 3.2b

Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2016); GA (2011)

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3.2.4 Objects of the Act

The objects of the EP&A Act are specified in Section 1.3 of the Act and seek to promote the management and conservation of natural and artificial resources, while also permitting appropriate development to occur. The objects of the EP&A Act are reproduced below, followed by consideration of the consistency of the project with these objectives.

> (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources

The project will facilitate the recovery of approximately 200,000 ounces of gold per annum. Through the project Regis will develop a valuable resource by providing the necessary capital and skills, without which the resource would remain in situ and the economic benefits documented in Chapter 36 and social benefits documented in Chapters 20 (mine development) and 33 (pipeline development), respectively, of this EIS would be not be realised.

The natural resources in the project application area include gold, land suitable for agricultural production, water resources, and land which has biodiversity and cultural heritage values. The project has been designed to efficiently recover the gold resource without unacceptable environmental impacts or impacts on existing and surrounding land uses. The project's surface infrastructure has been designed where possible to avoid sensitive biodiversity areas. For example, the original design extent of the TSF was reduced in the northern section of the mine project area to avoid areas containing an Endangered Ecological Community (refer to the discussion in Chapter 6 on alternative project designs considered). Impacts to surface water and groundwater resources have also been assessed as minimal, with all potential impacts to surface water users and stream environments assessed as insignificant in accordance with the *Significant impact guidelines* (DoE 2013). Where other impacts cannot be avoided, these have been mitigated or offset as described in Part D of this EIS.

The soil and land capability assessment for the project (refer to Chapter 7) identified the potential presence of Biophysical Strategic Agricultural Land (BSAL) within the mine project area. The disturbance footprint of the project was subsequently revised to avoid these BSAL areas, thereby avoiding impediment to the proper management and development of agricultural land. It is anticipated that an agricultural land use (such as grazing) will continue on land within the project area that has been excluded from the disturbance footprint and mining lease application area, during operation of the mine. The project will therefore continue to encourage the development of agricultural land in the project area.

Regis is committed to employing local residents, with all employees to live within an approximate 1-hour travel time of the mine. An average of around 260 personnel will be employed when the mine is fully operational, peaking at approximately 320 in around years four and five of operation, bringing associated flow-on benefits to surrounding local communities where these employees will reside. A local procurement policy will also be adopted, which will require local goods and services to be used in the project's construction and operation where possible, thereby maximising opportunities for local businesses.

> (b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment

The concept of ecologically sustainable development (ESD) when used in the EP&A Act has the same meaning it has in section 6(2) of the *Protection of the Environment Administration Act 1991*. The definition is discussed in greater detail in Chapter 39.

The Commonwealth Government's 1992 *National Strategy for Ecologically Sustainable Development* defines ESD as "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life now, and in the future, can be increased".

A comprehensive stakeholder engagement, planning and environmental assessment process has ensured that the principles of ESD are addressed by the project. Notably, an extensive baseline monitoring program has ensured that impacts can be confidently predicted as outlined in this EIS. Mitigation and management measures have been identified, thereby addressing the Precautionary Principle. Further discussion on the Precautionary Principle is provided in Section 39.7.

The project will enhance community resources by generating employment and public revenues through royalties and taxes, contributing to improvements to local, State and National economies. The project will also conserve community resources directly by establishing offset areas and indirectly through effective impact mitigation.

Further discussion on the consistency of the project with the principles of ESD is provided in Chapter 39.

> (c) to promote the orderly and economic use and development of land

The orderly and economic use of land is best served by development which is permissible under the relevant planning regime, is in accordance with the prevailing planning controls and which does not unduly restrict other beneficial uses around a project site. The project is a permissible development which is consistent with the relevant planning controls, as documented in this chapter. The project will recover a valuable mineral resource without significant residual impacts and will bring significant social and economic benefits to the region. The current land use of the mine project area is an agricultural use. The change to a mining lease and corresponding reduction in agricultural carrying capacity will result in a decline in the net value of agricultural production by $406 193/yr during the life of the mine. This equates to just under 1% of the $42.7 million of gross value of agriculture production in Blayney LGA in 2015/16 (ABS 2018). With a net benefit to NSW of between $141 million to $232 million, the project therefore represents the highest value land use compared to the existing agricultural use. Wages for labour will contribute to the regional economy, as well as regional spending for production related inputs.

The project is also responsive to its surroundings. As described in Chapter 6, the project design evolved throughout the environmental assessment process in response to findings of various technical studies so as to minimise impacts on surrounding land uses. These uses predominantly comprise agricultural related land uses. As discussed in detail in Chapter 8, the mine development has been designed such that it will not unduly restrict or significantly impact these uses. Where residual impacts are still predicted to occur, mitigation measures have been proposed to address these impacts, so that the project will not displace other beneficial uses in the locality.

> (d) to promote the delivery and maintenance of affordable housing

All employees will be required to live within a 1-hour travel distance during the operational phase of the mine, unless the specialist skills required for a particular role are not available from the local region. The outcomes of the Social Impact Assessment (SIA) suggest that most workers will be sourced from an existing labour pool within the region (including the LGAs of Blayney, Cabonne, Bathurst, Orange and Cowra) and therefore the project will not result in a significant population increase or pressure on housing availability at any specific location. Further detail on local housing supply impacts is provided in the SIA attached as Appendix T and summarised in Chapter 20.

> (e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

The project has been designed to address this objective. Iterative project planning informed by baseline studies has allowed a range of impacts to be avoided and others to be minimised throughout the life of the project. To compensate for unavoidable disturbance, biodiversity offsets will be provided, as discussed in detail in Chapter 13 (mine development) and Chapter 27 (pipeline development).

(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)

A total of 38 Aboriginal cultural heritage sites have been identified within the mine development project area; 37 sites identified as part of the Aboriginal cultural heritage survey conducted for the project and one identified by a previous study. Of these sites, 23 are located within the proposed disturbance footprint, and will therefore be impacted by the project. A further 10 sites are within areas close to the disturbance footprint and therefore may be subjected to indirect impacts. All sites comprise stone artefacts; either as artefact scatters or isolated finds. The artefact scatters contain small numbers of artefacts and are found in low densities. Further, all sites have been assessed to be of low scientific and cultural significance by the Aboriginal Cultural Heritage Assessment (Landskape 2019), as discussed further in Chapter 15. The sites to be impacted will be salvaged prior to surface disturbance occurring.

In addition, eight historical heritage sites assessed as being of local significance have been identified within areas to be impacted by the mine development, with a further four locally significant sites identified near the disturbance footprint which may be subject to indirect impacts. No listed historical heritage items are within the mine project area.

Within the pipeline corridor, 10 Aboriginal cultural heritage sites have been identified, six of which are in the direct disturbance footprint of the pipeline. The low number of sites found reflects the highly disturbed nature of the corridor.

Given the low number of Aboriginal cultural heritage and historic heritage sites within the disturbance footprint of the project, the low significance of sites identified, and the mitigation measures proposed (such as salvage and archival recording), the project will not significantly impact cultural heritage and is therefore consistent with this object of the Act.

(g) to promote good design and amenity of the built environment

The location of buildings required for the mine development (such as the administration building, workshop and stores) has been carefully chosen in consideration of the local topography and potential views of this infrastructure from residential locations. Subsequently, the infrastructure will be constructed in the central part of the mine project area, where views will be restricted due to topography from neighbouring residences. Further discussion on visual amenity in relation to the built elements of the project is provided in Chapter 19.

(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants

All buildings required for the project will be constructed in accordance with the applicable standards. Construction certificates will be required prior to construction of certain structures in the administration and processing area. Occupation certificates will also be required prior to use of certain buildings on site.

(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State

As outlined in Chapter 4, all Commonwealth, State, and local government agencies that have an interest in the project have been consulted with prior to and while this EIS was being prepared. This will continue as the Response to Submissions (RTS) report is prepared following public exhibition. All levels of government have been involved to date and this will continue as the project is assessed and determined.

(j) to provide increased opportunity for community participation in environmental planning and assessment.

As detailed in Chapter 4, Regis has consulted extensively with the community over a number of years. This process included numerous one on one meetings with landholders, a number of public information sessions, distribution of newsletters, interviews with local businesses and regular meetings with the Community Consultative Committee established for the project. Regis has maintained a local presence in Blayney since the very early stages of project planning. A local office was established in Blayney in 2013 in Charles Street before relocating to Adelaide Street in November 2017, giving members of the public an opportunity to find out about the project. Regis also established an exploration depot in the Blayney industrial area on Marshalls Lane in November 2017. Community feedback has helped shape the project and given local input to the EIS, as discussed in Chapter 4. The public will also be involved through the exhibition of the EIS. Any relevant public representations will be considered by the DPIE and IPC during assessment of the development application.

3.2.5 Section 4.15 Matters for consideration

When assessing a DA for SSD the consent authority is required to take into consideration the matters outlined in Section 4.15 of the EP&A Act. These matters are addressed in Table 3.1.

Table 3.1 Matters for consideration – Section 4.15 of the EP&A Act

Provision	Consideration
Any environmental planning instrument	All relevant environmental planning instruments are addressed in Section 3.5.
Any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority.	There are no proposed instruments relevant to the project.
Any development control plan	Clause 11 of the SRD SEPP states that development control plans do not apply to SSD. Clause 11 is given effect by the combined operation of Sections 4.40 and 4.43 of the EP&A Act which state: 4.40 - Section 4.15 applies, subject to this Division, to the determination of the application. 4.43 - The provisions of this Division, the regulations of this Division and any other provisions of or made under this Act with respect to State significant development prevail to the extent of any inconsistency with any other provisions of or made under this Act relating to development to which this Part applies.
Any planning agreement that has been entered into under Section 7.4, or any draft planning agreement that a developer has offered to enter into under Section 7.4.	Section 7.4 of the EP&A Act relates to planning agreements, which are defined as: … a voluntary agreement or other arrangement under this Division between a planning authority (or 2 or more planning authorities) and a person (the ***developer***): (a) who has sought a change to an environmental planning instrument, or (b) who has made, or proposes to make, a development application or application for a complying development certificate, or (c) who has entered into an agreement with, or is

Table 3.1 Matters for consideration – Section 4.15 of the EP&A Act

Provision	Consideration
	otherwise associated with, a person to whom paragraph (a) or (b) applies, under which the developer is required to dedicate land free of cost, pay a monetary contribution, or provide any other material public benefit, or any combination of them, to be used for or applied towards a public purpose. Section 7.4 enables the proponent of a development to enter into a VPA or other arrangement with planning authorities in lieu of Section 7.11 contributions. Regis has commenced discussions on the negotiation of a VPA with Blayney Shire Council relating to the mine development.
The regulations (to the extent that they prescribe matters for the purposes of this paragraph),	The requirements of the EP&A regulation are addressed in Section 3.2.6.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	This EIS comprehensively describes the likely impacts of the project based on the EARs, including environmental impacts on both the natural and built environments, and social and economic impacts in the local area, region and State. It also describes commitments proposed by Regis to mitigate and manage these impacts. These descriptions are based on technical studies prepared by specialists, which are appended to this EIS and summarised in Parts D and E. The technical studies were prepared using the most recent and accurate scientific data relevant to the project in consideration of current policies and legislation. In addition, the technical studies adopted conservative assumptions to enable the upper limit of likely impacts to be assessed.
The suitability of the site for the development	The mine project area is suitable for a mine development as it will efficiently recover an economic gold resource from privately owned land where mining is permissible. Further, a range of commitments have been made by Regis to mitigate potential impacts on surrounding land uses. When these commitments are applied, the project is unlikely to have significant land use impacts. The alignment of the pipeline corridor has been selected to avoid environmental impacts, in particular impacts on listed biodiversity. A detailed justification for the project, including consideration of the suitability of the site, is provided in Chapter 39.
Any submissions made in accordance with this Act or the regulations.	This EIS is to be placed on public exhibition for a minimum of 30 days by DPIE and submissions will be sought from local and State government agencies and the community. Any submissions received by DPIE will be reviewed and forwarded to Regis to consider and respond to (via a Response to Submissions (RTS) report). The consent authority will consider the submissions received during the public exhibition period on the project, as well as the EIS and RTS report and the outcomes of any public hearing/meeting if held, in assessing the project.

Table 3.1 Matters for consideration – Section 4.15 of the EP&A Act

Provision	Consideration
The public interest	To assist the consent authority in determining whether the project is in the public interest, this EIS provides a justification for the project (refer to Chapter 39), taking into consideration its potential environmental, social and economic impacts and the suitability of the site. It also considers the project against the principles of ESD. The consent authority will also be required to consider all submissions received during the public exhibition of the EIS.

3.2.6 Environmental Planning and Assessment Regulation 2000

Provisions of the EP&A Regulation relevant to the project are identified in the following sub sections.

i Clause 50A

Clause 50A of the EP&A Regulation outlines special provisions relating to development applications relating to mining or petroleum development on strategic agricultural land.

As the project involves a mining development within the meaning of Part 4AA of the Mining SEPP, clause 50A of the EP&A Regulation requires that the development application be accompanied by either:

- a "Gateway Certificate", where the development occurs on land which meets the definition of Biophysical Strategic Agricultural Land (BSAL); or
- a "Site Verification Certificate" that certifies that the land on which the proposed development is to be carried out is not BSAL.

Detailed soil and related resource studies were completed for the project in accordance with the NSW Government's (2013) *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land,* which identified potential BSAL within the project boundary of an earlier design of the mine development. The footprint of the mine development and the associated area to be the subject of a mining lease application were subsequently refined to avoid impacts on the identified potential BSAL. As a result, there is no BSAL within the mining lease application area for the proposed development. Accordingly, a site verification certificate (SVC) was applied for and subsequently issued by the Secretary of the DPIE on 18 June 2019. The SVC is attached as Appendix C, and further discussion on the SVC is provided in Chapter 7.

ii Schedule 2 requirements

As previously stated, a DA for an SSD project must be accompanied by an EIS, prepared in accordance with the EP&A Regulation. The requirements for preparation of an EIS are set out in Clause 6 and 7 of Schedule 2 of the EP&A Regulation. A summary of these requirements and where they are addressed in the EIS are provided in Table 3.2.

Table 3.2 Schedule 2 requirements for an EIS

Requirement	Where contained in the EIS
Clause 6 Form of environmental impact statement	
(a) the name, address and professional qualifications of the person by whom the statement is prepared,	Declaration at the start of this EIS
(b) the name and address of the responsible person,	Section 1.5
(c) the address of the land: (i) in respect of which the development application is to be made, or (ii) on which the activity or infrastructure to which the statement relates is to be carried out,	Schedule of lands in Appendix A
(d) a description of the development, activity or infrastructure to which the statement relates,	Chapter 2
(e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule,	Part D and Part E of this EIS
(f) a declaration by the person by whom the statement is prepared to the effect that: (i) the statement has been prepared in accordance with this Schedule, and (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and (iii) that the information contained in the statement is neither false nor misleading.	Declaration at the start of this EIS
Clause 7 Content of environmental impact statement	
(a) a summary of the environmental impact statement,	Executive summary
(b) a statement of the objectives of the development, activity or infrastructure,	Chapter 1
(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Chapter 6
(d) an analysis of the development, activity or infrastructure, including:	
(i) a full description of the development, activity or infrastructure, and	Chapter 2
(ii) a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	Chapter 5
(iii) the likely impact on the environment of the development, activity or infrastructure, and	Chapters 7-37
(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Chapters 7-37 and summarised in Chapter 38
(v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,	Chapter 3 and summarised in Section 3.8
(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Chapter 38
(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	Chapter 39

3.3 Requirements of other NSW legislation

3.3.1 Overview

In addition to development consent, the project will require several other authorisations. Under Section 4.42 of the EP&A Act, the following authorisations cannot be refused and are to be substantially consistent with a development consent for SSD:

a) an aquaculture permit under section 144 of the *Fisheries Management Act 1994*;

b) an approval under section 15 of the *Mine Subsidence Compensation Act 1961*;

c) a mining lease under the *Mining Act 1992*;

   Note. Under section 380A of the *Mining Act 1992*, a mining lease can be refused on the ground that the applicant is not a fit and proper person, despite this section.

d) a production lease under the *Petroleum (Onshore) Act 1991*;

   Note. Under section 24A of the *Petroleum (Onshore) Act 1991*, a production lease can be refused on the ground that the applicant is not a fit and proper person, despite this section.

e) an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act);

f) a consent under section 138 of the *Roads Act 1993*; and

g) a licence under the *Pipelines Act 1967*.

Of the above, only a mining lease (ML), Environment Protection Licence (EPL) and a Section 138 approval under the *Roads Act 1993* (Roads Act) are relevant to the project. In addition, water access licences may also be required under the *Water Management Act 2000* (WM Act). The approvals that are relevant to the project are discussed below.

3.3.2 Mining Act 1992

The *Mining Act 1992* (Mining Act) regulates mining in NSW and provides for the granting of mining authorities. It also places controls on methods of exploration and mining, disposal of mining waste, land rehabilitation and environmental management activities. It is an offence under section 5 of the Mining Act to mine for minerals except in accordance with a valid authorisation. Section 6 of the Mining Act provides that an authorisation is also required to carry out designated ancillary mining activities.

The project will require a mining lease under the Mining Act prior to the commencement of mining operations. The application area over which a mining lease will be applied for under the Mining Act, is shown in Figure 1.3. In accordance with Section 51 (3) of the Mining Act, an application for a mining lease can only be made by the holder of an exploration licence or assessment lease over the land, or with the Minister's consent. Regis holds EL 5760, EL 6111 and EL 5922 over the full mining lease application area, so it can apply for a mining lease in accordance with the Mining Act.

Section 4.42 of the EP&A Act mandates that a mining lease for an approved SSD project cannot be refused and is to be substantially consistent with the terms of the development consent for the SSD. It is also anticipated that the new mining lease will require the preparation and approval of a Mining Operations Plan (MOP).

Section 6 of the Mining Act stipulates that a person must not, on land that is not within the mining area of a mining lease, carry out a designated ancillary mining activity that is in the immediate vicinity of and that directly facilitates the mining lease concerned, except in accordance with:

(a) a condition of the mining lease that regulates the carrying out of the activity, or

(b) another mining lease in respect of an ancillary mining activity or activities only that authorises the carrying out of the activity.

The pumping station facility required for the pipeline development near Bathurst (pumping station facility No.4) will include a tank with a capacity of approximately 0.75 ML. This tank constitutes a designated ancillary mining activity, being a "reservoir" for the purposes of section 6 (6) of the Mining Act:

(6) Definition

In this section, ***designated ancillary mining activity*** means the following:

(a) the construction, maintenance or use of any **reservoir**, dam (including a tailings dam), drain or water race, other than any reservoir, dam, drain or water race principally used for purposes not connected with mining or any other activities regulated by or under an authorisation,

An application will therefore be made to include a condition on the mining lease for the project that authorises this ancillary mining activity.

3.3.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations 1997* (POEO Act) is the principal NSW environmental protection legislation which is administered by the EPA. Schedule 1 of the POEO Act lists the 'scheduled activities' which are to be regulated by an environment protection licence (EPL). Schedule 1 includes the following activities that are relevant to the project:

- mineral processing and mineral waste generation; and
- mining for minerals.

Each of these activities are described below:

i Mineral processing

Clause 27 of Schedule 1 of the POEO Act relates to 'mineral processing'. It provides that an activity which processes more than 150 tonnes per day (tpd) of ore (using methods including chemical, electrical, magnetic, gravity or physical-chemical) is a scheduled activity.

The project will process more than 150 tpd of ore. Therefore, the project is a scheduled activity under the POEO Act for the purposes of mineral processing and will require an EPL.

ii Mining for minerals

Clause 29 of Schedule 1 of the POEO Act relates to 'mining for minerals', meaning the mining, processing or handling of minerals, other than coal, at mines that are to disturb a total surface area of more than 4 ha of land; or in the case of a gold mine, more than 1 ha of land. The project is a proposed gold mine which will involve the mining, processing and handling of minerals and will disturb a total surface area exceeding 1 ha. The project is, therefore, a scheduled activity for the purposes of mining for minerals.

Accordingly, the project will require an EPL. Section 4.42 of the EP&A Act mandates that an application for an EPL for an approved SSD project cannot be refused and is to be substantially consistent with the terms of the development consent for the SSD.

3.3.4 Roads Act 1993

Under Section 138 of the Roads Act, work cannot be carried out in, on or over a public road unless the appropriate roads authority has given consent. The project will involve the connection of the mine access road with the Mid Western Highway, involving the construction of a new intersection on the highway. The Mid Western Highway is a classified road and therefore consent will be required from Roads and Maritime Services (RMS) for the construction of this intersection. As described in Chapter 4, consultation has been undertaken with RMS in relation to the location and design of this proposed new intersection.

Consent will also be required from Blayney Shire Council and Cabonne Shire Council for the closure of Dungeon Road (or realignment should council request this option). As can be seen in Figure 1.3, Dungeon Road currently traverses the mine project area and provides access to a small of number properties. The closure of the road has been considered as part of the traffic assessment, as discussed in Chapter 17. There are two rural properties with dwellings that have access from Dungeon Road at the southern end. The road closure is expected to have no impact on these properties as their access to Blayney or Bathurst via the Mid Western Highway will remain unchanged. At the northern end of Dungeon Road, Regis has acquired all properties that have access from Dungeon Road. Consultation has been undertaken with Council in relation to Dungeon Road, as outlined in Chapter 4.

Approval from RMS will also be required for the pipeline development for the crossing of a number of roads, including the Castlereagh Highway, the Mid Western Highway, and the Great Western Highway. Approval will also be required for works relating to the crossing of local roads from Bathurst Regional and Lithgow Councils.

Section 4.42 of the EP&A Act stipulates that an approval under Section 138 cannot be refused and is to be substantially consistent with the development consent for the SSD.

3.3.5 Pipelines Act 1967

The *Pipelines Act 1967* (Pipelines Act) sets licensing requirements for the construction and operation of pipelines. The project includes the construction and operation of a raw water supply pipeline approximately 90 km long. Under Section 5(1)(d) of the Act, a pipeline constructed for the purposes of the supply of water, or the conveyance of wastewater, mine water or mineral tailings, is not required to be licensed. Therefore, the water supply pipeline and other pipelines required within the mine development project area will not require a licence under the Pipelines Act.

3.3.6 Water Management Act 2000 and Water Act 1912

The *Water Act 1912* (Water Act) has historically been the main legislation for the management of NSW water resources. However, the Water Act is progressively being repealed and replaced by the NSW *Water Management Act 2000* (WM Act) on a water source by water source basis as water sharing plans (WSPs) commence. In relation to surface water resources, the mine development is within the area covered by the *Water Sharing Plan for the Lachlan Unregulated Rivers and Alluvial Groundwater Sources 2012* (the Lachlan Unregulated Rivers WSP), within the Belubula River Upstream Carcoar Dam Unregulated River Water Source (Unregulated Belubula River Water Source). For groundwater, the mine project area is in the Lachlan Fold Belt Murray Daring Basin Groundwater Source. Groundwater in this source is managed by the *WSP for the New South Wales Murray-Darling Basin Fractured Rock Groundwater Sources 2011*. Therefore, most aspects of water management come under the WM Act.

However, some aspects of the Water Act are still operational across all of NSW, such as licences for monitoring bores.

As discussed in Section 3.4 below, Section 4.41 of the EP&A Act removes the need for a number of approvals under the WM Act when development consent has been granted for SSD. This includes a water use approval under Section 89, a water management work approval under Section 90 and an activity approval (other than an aquifer interference approval) under Section 91 of the WM Act.

However, water access licences (WALs) under the WM Act and bore licences under the Water Act may be required for the mine development portion of the project.

The water licensing requirements identified for the mine development are discussed in Chapter 9.

3.3.7 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) commenced on 25 August 2017, which repealed the following:

- *Threatened Species Conservation Act 1995* (TSC Act);
- sections of the *National Parks and Wildlife Act 1974*; and
- *Native Vegetation Act 2003*.

The BC Act establishes a new regulatory framework for assessing and offsetting biodiversity impacts for proposed developments. Where development consent is granted, the consent authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the Biodiversity Assessment Method (BAM).

The BC Act is also supported by the *Biodiversity Conservation Regulation 2017* and the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, which outline the methods to be used in applying the BAM, and specific considerations for transitional projects immediately following commencement of the new framework.

In this EIS, an assessment of biodiversity has been undertaken in accordance with the EARs as follows:

> an assessment of the direct and indirect biodiversity impacts of the development throughout its life, and impacts on biodiversity values in the region, which:
>
> - for the open cut mine is assessed in accordance with the *Framework for Biodiversity Assessment*; and includes a strategy to offset any residual impacts in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
> - for the water supply pipeline is assessed in a Biodiversity Development Assessment Report in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method, and includes a strategy to offset any residual impacts in accordance with the *Biodiversity Conservation Act 2016* (NSW);

The biodiversity assessment of the mine development is summarised in Chapter 13 of this EIS and appended as Appendix N.

The biodiversity assessment of the pipeline development is summarised in Chapter 27 of this EIS and included as Appendix X.

3.3.8 Dams Safety Act 1978

The *Dams Safety Act 1978* (DS Act) established the Dams Safety Committee to approve and maintain records of 'prescribed dams' in NSW. Prescribed dams are defined in Schedule 1 of the DS Act. The TSF, and perhaps the secondary water management facility, will be a prescribed dam in accordance with the provisions of the Act and will therefore require inclusion in Schedule 1.

3.3.9 Forestry Act 1916

The *Forestry Act 2012* (Forestry Act) provides for the dedication, management and use of State forests and other Crown-timber land for forestry and other purposes.

As illustrated in Figure 1.3 sections of the pipeline corridor will traverse State forests. The project will comply with the relevant requirements of the Forestry Act.

3.3.10 Crown Lands Act 1989

The *Crown Land Management Act 2016* (CL Act) provides for the ownership, use and management of Crown land. In particular, specific use of Crown land generally needs to be authorised by a lease, licence or permit. The NSW Department of Industry – Lands & Water (DoI Lands and Water) is responsible for administering the CL Act.

As part of consultation with DoI Lands and Water, a number of Crown roads have been identified within the project application area. These roads will require closing, which will be undertaken in consultation with DoI Lands and Water in parallel with the assessment and approval process for the project.

The pipeline traverses some areas of Crown land, including waterways and several State forests. An application for an easement across these areas of Crown land will be submitted to DoI Lands to allow works in these areas.

3.3.11 Local Government Act 1993

Section 68 of the *Local Government Act 1993* (Local Government Act) requires approval of the relevant local council to build and operate a sewage management system. As described in Chapter 2, sewage will be treated at an onsite treatment plant. Approval from Blayney Shire Council will be required prior to the construction of the sewage treatment plant.

3.3.12 Work Health and Safety Act 2011 and Work Health and Safety (Mines) Act 2013

The *Work Health and Safety Act 2011* seeks to ensure the health and safety of workers. The *Work Health and Safety (Mines and Petroleum Sites) Act 2013* supplements the provisions of the *Work Health and Safety Act 2011* by providing additional health and safety requirements specifically for mines. The project will implement the necessary policies, training and procedures required under these Acts, including obtaining licences to store and handle dangerous goods. Further information on hazards and safety is provided in Chapter 18.

3.3.13 Water Industry Competition Act 2006

The *Water Industry Competition Act 2006* (WIC Act) was introduced with the objective of encouraging competition in relation to the supply of water and the provision of sewerage services and to facilitate the development of infrastructure for the production and reticulation of recycled water, and for other purposes.

Under the WIC Act, a corporation (other than a public water utility) must obtain a network operator's licence to construct, maintain or operate any water industry infrastructure, and must obtain a retail supplier's licence to supply water (potable or non-potable) or provide sewerage services by means of any water industry infrastructure.

The Independent Pricing and Regulatory Tribunal (IPART) administers the licensing of private water utilities in NSW under the WIC Act. The WIC Act and its policy development are administered by the DPIE.

Preliminary comments received from the DPIE indicate that the pipeline development would fall within the current WIC Act licensing regime. Whether one or more licences are ultimately required is dependent upon further detailed design of the pipeline, and discussion with IPART in relation to the possible application of licensing exemptions. If a network operator's licence is required, this will need to be obtained prior to construction of the pipeline.

The *Water Industry Competition Amendment (Review) Act 2014* (WICA Review Act) was passed in October 2014. The objective of the WICA Review Act is to make amendments to the WIC Act in order to narrow the licensing regime to particular classes of water industry infrastructure. Despite being made in 2014, a number of provisions of the WICA Review Act are yet to commence and have been deferred pending administrative arrangements being put in place.

It is expected that, upon commencement of Schedule 1 of the WICA Review Act, the licensing regime under the WIC Act would not apply to the pipeline development. Accordingly, no WIC Act licences would be required.

IPART has indicated that Schedule 1 of the WICA Review Act is scheduled to commence in late 2019, following the completion of proposed amendments to the *Water Industry Competition (General) Regulation 2008*.

A licence application will not be determined by IPART until development consent for the proposed pipeline development has been obtained. It is anticipated that determination of the project application will not occur before the relevant WIC Act amendments have commenced.

An application for a licence under the WIC Act would only be anticipated where the pipeline development is required to be licensed under the WIC Act at the time of commencement of construction.

3.4 Exemptions from other NSW approval requirements

Pursuant to Section 4.41 of the EP&A Act, the following authorisations under other NSW legislation are not required for an approved SSD project:

- A permit under section 201, 205 or 219 of the *Fisheries Management Act 1994;*
- An approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977;*
- An Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974;*
- A bush fire safety authority under section 100B of the *Rural Fires Act 1997*; and
- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the WM Act.

While the above approvals are not required it is necessary to describe how they relate to the project. Approvals under the WM Act have been discussed above in Section 3.3.6. The remaining are discussed below.

3.4.1 Fisheries Management Act

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. It lists threatened aquatic species and ecological communities and contains measures to conserve these.

An assessment of the potential impacts on aquatic ecology is contained in Part D Chapter 14 (mine development) and Part E Chapter 27 (pipeline development) of this EIS. The aquatic assessment for the mine development concluded that there is unlikely to be any significant impact as a result of the mine to threatened species, populations or ecological communities listed under the FM Act or EPBC Act, within the aquatic or riparian environments of the Belubula River and associated tributaries, upstream of Carcoar Dam. Notably, assessed habitat in the mine project area, and local conditions in general, are highly degraded and influenced by pastoralism and agricultural uses, limiting their functionality as key fish habitat.

In relation to the pipeline development, two major watercourses to be crossed (Queen Charlottes Creek and the Macquarie River) will be underbored to avoid any potential for impacts to threatened species or key fish habitat. All other watercourses will be crossed using open trenching. These works will be undertaken in accordance with NSW DPI *Policies and Guidelines on Fish-Friendly Waterway Crossings* (undated), *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI 2013), and *NSW Guidelines for Controlled Activities* (NOW).

Further discussion on the potential impacts to aquatic ecology, and the proposed management and mitigation measures to address residual impacts, are provided in the technical reports in Appendix O (mine development) and Appendix Y (pipeline development).

3.4.2 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to protect and conserve the natural and cultural history of NSW, including scheduled heritage items, sites and relics. No items listed on the Blayney LEP or Cabonne LEP, or the State Heritage Register, are within the mine development project area. However, a number of items deemed to be of local significance have been identified within the disturbance footprint of the mine. Mitigation measures including archival recording will be implemented for these items, as discussed further in Chapter 16.

No listed heritage items are within the pipeline corridor. Two listed items are adjacent to the pipeline corridor (one listed on the Bathurst LEP and one on the Lithgow LEP); however, the pipeline is outside the curtilages of these items, and no impact on these sites is predicted, as discussed in further detail in Chapter 29.

Division 8 of Part 6 of the Heritage Act does not apply to prevent or interfere with the carrying out of SSD authorised by a development consent by virtue of section 4.41 of the EP&A Act. Nevertheless, potential heritage impacts of the project are assessed in detail in Part D Chapter 16 and Part E Chapter 29.

3.4.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for nature conservation in NSW, including the conservation of places, objects and features of significance to Aboriginal people and protection of native flora and fauna. A person must not harm or desecrate an Aboriginal object or place without an Aboriginal heritage impact assessment under Section 90 of the NPW Act. However, a Section 90 permit is not required for SSD approvals by virtue of Section 4.41 of the EP&A Act.

Potential Aboriginal heritage impacts of the project are assessed in detail in Part D Chapter 15 and Part E Chapter 28. As summarised above in Section 3.2.4, no Aboriginal cultural heritage sites deemed to be of high significance have been identified in the mine development project area. 38 sites of low scientific and cultural significance have been identified; 23 of which are in the direct disturbance footprint of the mine. These sites will be salvaged prior to any surface disturbance of these sites occurring. In addition, seven Aboriginal cultural heritage sites have been identified within the disturbance footprint of the pipeline, which will be salvaged. The low number of sites found reflects the highly disturbed nature of the corridor.

3.4.4 Rural Fires Act 1997

The *Rural Fires Act 1997* (RF Act) aims to prevent, mitigate, and suppress bush and other fires in local government areas of the State. Section 63(2) of the RF Act requires the owners of land to prevent the ignition and spread of bushfires on their land. Under Section 4.41 of the EP&A Act, a bushfire safety authority under Section 100B of the RF Act is not required for SSD that is authorised by a development consent. Notwithstanding, a bushfire management plan will be prepared for the mine, as part of the site's Environmental Management System.

Further discussion on hazard and risk, including bushfire, is provided in Part D Chapter 18 and Part E Chapter 31.

3.5 Environmental Planning Instruments

3.5.1 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The Mining SEPP provides for the proper management and development of mineral, petroleum and extractive resources for the social and economic welfare of NSW. It also establishes planning controls to encourage ecologically sustainable development within the mining, petroleum and extractive sectors. The Mining SEPP defines the permissibility of mining projects, and the additional matters that must be considered by a consent authority when evaluating development applications for mining.

i Aims

Clause 2 of the Mining SEPP sets out its aims of the policy as follows:

> The aims of this Policy are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries:
>
> (a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and
>
> (b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and
>
> (b1) to promote the development of significant mineral resources, and
>
> (c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and
>
> (d) to establish a gateway assessment process for certain mining and petroleum (oil and gas) development:
>
> (i) to recognise the importance of agricultural resources, and
>
> (ii) to ensure protection of strategic agricultural land and water resources, and
>
> (iii) to ensure a balanced use of land by potentially competing industries, and

(iv) to provide for the sustainable growth of mining, petroleum and agricultural industries.

This EIS and in particular, Chapter 38 provide a justification of the project's accordance with these aims.

ii Permissibility

The project is permissible with development consent as discussed in Section 3.2.3.

iii Matters for consideration

a Non-discretionary development standards

Clause 12AB of the Mining SEPP sets out a number of non-discretionary development standards that are to be considered in accordance with Sections 4.15 (2) and (3) of the EP&A Act for mining developments. These standards relate to cumulative noise levels, cumulative air quality levels, airblast overpressure, ground vibration and aquifer interference. These standards are addressed in Part D (Chapters 10, 11 and 9) respectively for noise and vibration, air quality and water resources.

b Compatibility of the mine with other uses

Clause 12 of the Mining SEPP requires a consent authority to consider the compatibility of the development with other land uses. It states:

> Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:
>
> (a) consider:
>
> (i) the existing uses and approved uses of land in the vicinity of the development, and
>
> (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and
>
> (iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and
>
> (b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and
>
> (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

Land uses near the mine are described in Chapter 5, and predominately include agricultural, rural residential and forestry. Potential impacts on these land uses have been assessed in this EIS, demonstrating that the project will not have a significant impact on existing and approved land uses around the project. Further discussion on this aspect is provided in Chapter 39.

c Consideration of voluntary land acquisition and mitigation policy

Clause 12A of the Mining SEPP requires the consent authority to consider any applicable provisions of the voluntary acquisition and mitigation policy before determining SSD mining, petroleum production or extractive industry applications. The policy referred to in Clause 12A is the *Voluntary Acquisition and Mitigation Policy* (VLAMP), which was published by the Minister for Planning in the Government Gazette on 19 December 2014 and revised in September 2018. The VLAMP describes how the consent authority is to deal with predicted noise and dust impacts from State significant mining proposals when determining DAs.

The VLAMP establishes a framework for ensuring that if noise and dust impacts from a proposal exceed the relevant assessment criteria, land owners are provided with:

- a negotiated agreement between the land owner and the proponent; or
- obligations on the proponent to offer mitigation measures or acquisition of the land, in accordance with conditions of a project approval.

The policy expresses a preference for negotiated agreements, although specifies some minimum requirements for those agreements. It also notes the kinds of mitigation commitments and the terms of land acquisition offers which would be required in any approval conditions imposed under the policy.

The provisions of the VLAMP have been considered in the noise and air quality assessments, as discussed in detail in Chapters 10 and 11 respectively. In relation to air quality, with the exception of one property that Regis have negotiated an option to purchase (R38), the results of dispersion modelling demonstrated compliance with the relevant VLAMP criteria for both mitigation and acquisition at all nearest privately owned residences. In addition, no exceedances of relevant VLAMP criteria are predicted across more than 25% of any privately-owned land.

In relation to noise, and as described in both Chapter 6 (project evolution) and Chapter 10 (noise and vibration) of this EIS, significant work has been undertaken to identify and consider all reasonable and feasible measures that could be implemented to avoid and minimise noise impacts from the mine as much as possible, particularly on the residences closest to the development in Kings Plains. This included scheduling the waste rock emplacement so that the southern face (closest to Kings Plains) is constructed first, and as quickly as possible within relevant noise limits, so that it can form both a noise and visual bund for the remainder of operations.

With all reasonable and feasible measures in place, a total of 16 residences in Kings Plains will be entitled to voluntary mitigation rights as a result of predicted exceedances of the Project Noise Trigger Levels (PNTLs) by greater than 2dB, but less than 5 dB, during the initial years of the mine development. Regis has already entered into an agreement with one of these landholders (identified as R38) with an option to purchase this property subject to project approval, bringing the number of residences to 15. The predicted exceedances are attributed to the construction of the southern face of the waste rock emplacement (southern amenity bund) and the early development of the open cut pit, before works are deep enough in the pit to provide effective shielding.

A detailed discussion on the predicted residual noise impacts of the development and proposed mitigation and management is provided in Chapter 10 and Appendix L (MAC 2019a).

d Compatibility of the proposal with mining

Clause 13 of the Mining SEPP relates to matters a consent authority must take into consideration when determining applications for development that is:

- in the vicinity of an existing mine, petroleum production facility or extractive industry;
- identified on a map as being the location of State or regionally significant resources of minerals, petroleum or extractive materials; or
- identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials.

Clause 13(2) states:

> Before determining an application to which this clause applies, the consent authority must:

(a) consider:

(i) the existing uses and approved uses of land in the vicinity of the development, and

(ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and

(ii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and

(b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a)(i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).

Therefore, this clause, insofar as it is relevant, requires the consent authority to consider the project's potential impact on other mining, petroleum production and extractive industries in the local area.

The other mining and extractive industries in the local area are described in Chapter 5 (site and surrounds). There are no petroleum production industries in the area. Regis holds all of the ELs across the mining lease application area, as shown in Figure 1.3. The north-western tip of the mine development project area (which is slightly larger than the mining lease application area) extends into an EL held by another party (EL 6378) by 12.28 ha (ie 0.5% of the mine project area). No disturbance is proposed in EL 6378 and it will not be impacted by the project. The mine development will not impact any other ELs.

The largest operating mine closest to the mine development project area is Cadia Valley Operations (Cadia), approximately 26 km east of the McPhillamys project area, as shown in Figure 1.2. Cadia is a large gold mining operation, comprising three mines; one in operation (the Cadia East underground mine), and two currently in care and maintenance (Ridgeway underground and Cadia Hill open cut). Cadia East has approval to operate until 2031, with an average of 880 employees. Cadia straddles two LGAs; Blayney and Cabonne. Given the distance of Cadia from the McPhillamys mine development project area, the project is highly unlikely to impact on the operations at Cadia. In addition, the Cadia dewatering facility is located approximately 4.7 km south-west of the mine project area, off Newbridge Road. Again, given the distance from the project area, the McPhillamys project will not impact this component of Cadia.

Other extractive industries in the area include the Cow Flat Quarry, a limestone quarry approximately 21 km south-east of the McPhillamys mine project area. The MLs for this quarry are held by Omya Australia Pty Limited. Australian Native Landscapes (ANL) also hold three mining leases (ML 910, ML 911 and ML 912), approximately 8.3 km west of Blayney. ANL operate an organics facility in this location.

A detailed discussion on cumulative impacts is provided in Part F of this EIS. As concluded in that discussion, due to the large distances between the mine project area and other mining operations, the project will not directly or indirectly impact on any of the other mines in the Central West.

In relation to the pipeline development, the proposed corridor intersects a number of mining tenements, as shown in Figure 5.6 (refer to Chapter 5). With the exception of one EL, these tenements are held by Centennial Coal Company (or affiliated companies). It also crosses one EL (6304) held by Mr Donald John Perkin. As required by the EARs, consultation with these tenements holders has been undertaken to ensure they are aware of the development, as described in Chapter 4.

e Natural resource and environmental management

Clause 14 of the Mining SEPP requires the consent authority to consider natural resource management, and states:

> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:
>
> (a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,
>
> (b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,
>
> (c) that greenhouse gas emissions are minimised to the greatest extent practicable.
>
> (2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.
>
> (3) Without limiting subclause (1), in determining a development application for development for the purposes of mining, the consent authority must consider any certification by the Chief Executive of the Office of Environment and Heritage or the Director-General of the Department of Primary Industries that measures to mitigate or offset the biodiversity impact of the proposed development will be adequate.

An assessment of greenhouse gas emissions, biodiversity and water resources for the mine development are addressed in Part D Chapters 12, 13 and 9 respectively and for the pipeline development in Part E Chapters 26, 27 and 24.

f Resource recovery

Clause 15 of the Mining SEPP requires the consent authority to consider the efficiency of the development in terms of resource recovery.

The project has adopted a mine plan and mining method that optimises resource recovery without causing unacceptable environmental impacts. The project has been developed after several years of detailed geological, metallurgical, engineering, environmental, financial and other technical investigations; a process which included the investigation of several alternatives which are discussed in detail in Chapter 6. The project presented in this EIS is the most practical and appropriate method for recovering the resource.

g Transport

Clause 16 of the Mining SEPP requires the consent authority to consider the implications of transport of materials on public roads.

As discussed in Chapter 17, all ore extracted by the mine will be processed onsite and as a result, there will be no heavy vehicle haulage of ore from the mine on public roads. Heavy vehicle movements to and from the site will be limited to the delivery of reagents and goods required at the mine. Deliveries and visitors to the mine during operations are estimated to comprise approximately 30 vehicles (20 light vehicles and 10 heavy vehicles) per day.

h Rehabilitation

Clause 17 of the Mining SEPP requires the consent authority to consider rehabilitation of land that will be affected by the development.

The project will rehabilitate all land that is disturbed by mining operations, apart from the final void which be treated so that it will remain in a safe and stable condition, as described in Chapter 22.

i Mining on strategic agricultural land and site verification certificates

Part 4AA of the Mining SEPP concerns 'mining or petroleum development' on strategic agricultural land.

Clause 17A provides a definition of mining and petroleum development for the purposes of Part 4AA. It states:

> (1) In this Part, ***mining or petroleum development*** means:
>
> > (a) development specified in clause 5 (Mining) of Schedule 1 to *State Environmental Planning Policy (State and Regional Development) 2011*, but only if:
> >
> > > (i) a mining lease under the *Mining Act 1992* is required to be issued to enable the development to be carried out because:
> > >
> > > > (A) the development is proposed to be carried out outside the mining area of an existing mining lease, or
> > > >
> > > > (B) there is no current mining lease in relation to the proposed development, or
> > >
> > > ...

The project is development specified in Clause 5 (mining) of the SRD SEPP and a mining lease is required. Therefore, Part 4AA of the Mining SEPP applies to the project.

Division 3 of Part 4AA relates to site verification certificates. The note to this division states:

> **Note.** Clause 50A of the *Environmental Planning and Assessment Regulation 2000* requires that a development application for consent to mining or petroleum development on certain identified land (including land shown on the *Strategic Agricultural Land Map*) must be accompanied by:
>
> (a) a gateway certificate, or
>
> (b) a site verification certificate that certifies that the land on which the proposed development is to be carried out is not biophysical strategic agricultural land.

A site verification certificate for the mine development has been obtained (attached in Appendix C).

Clause 17A (2) states that the definition of "mining or petroleum development" does not include development carried out on land that is outside the mining area of a proposed mining lease. As such, the pipeline development component of the project is not part of the "mining or petroleum development" for the purpose of Part 4AA of the Mining SEPP.

3.5.2 State Environmental Planning Policy (State and Regional Development) 2011

Under State Environmental Planning Policy (State and Regional Development 2011) (SEPP State & Regional Development) various activities are set out in Schedule 1 as being State Significant Development (SSD). The applicability of the SEPP is discussed in Section 3.2.2.

3.5.3 State Environmental Planning Policy No. 33 Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) may require the consent authority to consider a project's potential to cause hazards or be offensive, including consideration of the location of the development and the way in which it is to be carried out. Clause 13 states:

> In determining an application to carry out development to which this Part applies, the consent authority must consider (in addition to any other matters specified in the Act or in an environmental planning instrument applying to the development):
>
> (a) current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development, and
>
> (b) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply, and
>
> (c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and
>
> (d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), and
>
> (e) any likely future use of the land surrounding the development.

In accordance with the DPE's guideline *Applying SEPP 33* (DoP 2011a) the mine development is deemed a "potentially hazardous industry" due to the storage and use of reagents on site.

A preliminary hazard analysis workshop and subsequent assessment was therefore carried out for the project in accordance with clause 12 of SEPP 33 (Risk Mentor 2019, refer to Appendix R). This assessment concluded that the development does not constitute a hazardous or offensive development in accordance with SEPP 33.

3.5.4 State Environmental Planning Policy Infrastructure 2007

The project is currently exploring two separate options for the mine developments primary power supply. The first option is the duplication of the existing 66 kV line from Bathurst. The second option under assessment is to supply the site from the Transgrid 132 kV system Line 948 which passes between Bathurst and Orange approximately 14 kilometres to north of the processing plant.

Separate approval under Part 5 of the EP&A Act and Part 3, Division 5 (Electricity transmission or distribution) of the *State Environmental Planning Policy Infrastructure 2007* (Infrastructure SEPP) will be sought to construct and operate this additional 66 kV line.

Clause 101 of the Infrastructure SEPP identifies that where a development has a frontage to a classified road, development consent must not be granted unless the consent authority is satisfied that:

> (a) where practicable and safe, vehicular access to the land is provided by a road other than the classified road, and
>
> (b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of:

i) the design of the vehicular access to the land, or

ii) the emission of smoke or dust from the development, or

iii) the nature, volume or frequency of vehicles using the classified road to gain access to the land, and

b) the development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.

The mine development, and in particular the mine access road, has been designed in consultation with Roads and Maritime Services so as to not adversely affect the safety, efficiency and ongoing operation of the Mid Western Highway. The pipeline development will generally cross all classified roads via underboring to ensure impacts on these roads are negligible.

3.5.5 State Environmental Planning Policy No 55 Remediation of Land

State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) provides a state-wide approach to the remediation of contaminated land for the purpose of minimising the risk to human health and the environment. Clause 7 of SEPP 55 states:

(1) A consent authority must not consent to the carrying out of any development on land unless:

(a) it has considered whether the land is contaminated, and

(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and

(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

(2) Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.

(3) The applicant for development consent must carry out the investigation required by subclause (2) and must provide a report on it to the consent authority. The consent authority may require the applicant to carry out, and provide a report on, a detailed investigation (as referred to in the contaminated land planning guidelines) if it considers that the findings of the preliminary investigation warrant such an investigation.

(4) The land concerned is:

(a) land that is within an investigation area,

(b) land on which development for a purpose referred to in Table 1 to the contaminated land planning guidelines is being, or is known to have been, carried out,

(c) to the extent to which it is proposed to carry out development on it for residential, educational, recreational or child care purposes, or for the purposes of a hospital—land:

(i) in relation to which there is no knowledge (or incomplete knowledge) as to whether development for a purpose referred to in Table 1 to the contaminated land planning guidelines has been carried out, and

(ii) on which it would have been lawful to carry out such development during any period in respect of which there is no knowledge (or incomplete knowledge).

The likelihood of contamination occurring in the project area was assessed to determine whether the site is suitable for the uses proposed. The investigation concluded there is no material evidence of widespread or significant contamination activities and/or contamination sources in the project area. Regis has not encountered evidence of land contamination during any of its extensive exploration and environmental studies, which supports the outcome of the investigation that contamination is unlikely to be present on the site. Accordingly, it is considered that the site is likely to be uncontaminated and is suitable for the uses proposed.

3.5.6 State Environmental Planning Policy No 44 Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) encourages the conservation and management of Koala (*Phascolarctos cinereus*) habitat, to ensure permanent free-living Koala populations are maintained over their present range.

Part 2 of SEPP 44 applies to any development application of at least 1 ha within any of the 107 local government areas (LGAs) listed under Schedule 1 of SEPP 44. Blayney, Cabonne, Greater Lithgow and Bathurst Regional LGAs are listed under Schedule 1 of SEPP 44 and as such this SEPP applies to the majority of the project application area (ie all of the mine development project area and the majority of the pipeline corridor).

SEPP 44 classifies areas as 'potential' and 'core' Koala habitat. *Potential Koala habitat* refers to areas of native vegetation where the trees of the types listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. *Core Koala habitat* refers to areas of land with a resident population of koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population.

One feed tree species listed in Schedule 2 of SEPP 44, Manna Gum (*E. viminalis*), was found in the mine development disturbance footprint (the study area) during field surveys for the Biodiversity Assessment (EMM 2019c). Only one Koala was observed opportunistically in the study area, despite targeted spot assessments and spotlighting surveys. No breeding or young were observed. Accordingly, the Biodiversity Assessment (EMM 2019c) concluded that the study area is unlikely to represent core Koala habitat. Notwithstanding, vegetation in the mine project area was found to represent habitat critical to the survival of the Koala. Therefore, offsets for Koala have been included in the biodiversity offset strategy for the project (refer to Appendix N and Chapter 13).

E. viminalis was also identified within the pipeline corridor. Targeted searches for Koala were subsequently conducted, with no evidence of the presence of Koala found. However, the Biodiversity Assessment for the pipeline (OzArk 2019a) assumed all areas of the plant community type (PCT) associated with Koala within the subject land are potential Koala habitat, and accordingly the offset requirement for this component of the project also includes species credits for Koala.

Under clause 7 of SEPP 44, "a council" must comply with clause 8 if satisfied that the land to which Part 2 of SEPP 44 applies, is a "potential koala habitat".

Clause 8 states as follows:

> (1) Before a council may grant consent to an application for consent to carry out development on land to which this Part applies that it is satisfied is a potential koala habitat, it must satisfy itself whether or not the land is a core koala habitat.
>
> (2) A council may satisfy itself as to whether or not land is a core koala habitat only on information obtained by it, or by the applicant, from a person with appropriate qualifications and experience in biological science and fauna survey and management.
>
> (3) If the council is satisfied:
>
> > (a) that the land is not a core koala habitat, it is not prevented, because of this Policy, from granting consent to the development application, or

(b) that the land is a core koala habitat, it must comply with clause 9.

Further, clause 10 states:

> Without limiting clause 17, a council must take the guidelines into consideration in determining an application for consent to carry out development on land to which this Part applies.

3.5.7 Local Environmental Plans

The mine development is predominately within the Blayney LGA, with a small portion in the Cabonne LGA. The pipeline development also traverses the Blayney, Bathurst and Lithgow LGAs. Consideration of the relevant land use zones and permissibility of the development is discussed in Section 3.2.3.

3.6 Strategic policies

3.6.1 Central West and Orana Regional Plan 2036

The *Central West and Orana Regional Plan 2036* (the Regional Plan) was released by the DPIE (2017a) to guide land use planning priorities and decision making in the Central West and Orana Region for the next two decades. The region covered by the plan comprises the Cabonne, Orange, Blayney, Bathurst Regional, Lithgow, Oberon, Lachlan, Parkes, Forbes, Weddin and Cowra LGAs (Central West), and the Bogan, Warren, Coonamble, Gilgandra, Narromine, Warrumbungle and Dubbo Regional Mid-Western Regional LGA's (Orana). The Regional Plan provides an overarching framework to guide local land use plans, development proposals and infrastructure funding decisions. The implementation component of the Regional Plan includes priority actions and medium-long term actions.

The Regional Plan identifies the mining sector as the largest contributor to the regional economy, comprising $2.5 billion (16.2%) of gross regional product in 2011 and employing 5% of the regional workforce. The vision for the Central West and Orana region is for mining to continue to provide local job opportunities and make a significant regional economic contribution. Specifically, and of relevance to the project, is that mining is identified as one of the top three economic opportunities for the Blayney and Cabonne LGAs.

The Regional Plan sets four broad goals for the region;

1. The most diverse regional economy in NSW;
2. A stronger, healthier environment and diverse heritage;
3. Quality freight, transport and infrastructure networks;
4. Dynamic, vibrant and healthy communities.

The project is consistent with Goal 1, as it will contribute significantly to the diversity of economic development and employment in the region and will enable the realisation of the economic opportunity that mining presents, as identified in the plan and mentioned above. The Regional Plan also sets a number of 'directions' for each goal. The project is consistent with the sustainable management of mineral resources actions identified in Direction 8 for Goal 1, which states that the sustainable management of mineral resources must consider and balance varying impacts to produce long-term economic, social and environmental outcomes. As discussed in Chapter 36, the project will deliver significant economic benefits to the region. Regis is committed to the employment of a majority local workforce, and through the implementation of training and apprenticeship programs will deliver long-term social benefits to the region. Implementation of the rehabilitation and closure strategy (refer to Chapter 22) will also ensure that the project leaves a stable and sustainable post-mining landform.

Through the appropriate application of mitigation measures identified in this EIS, the project will also be consistent with the actions to protect the region's important environmental assets, as committed to in Goal 2 of the Regional Plan. The project's proposed measures to manage water resources in accordance with Direction 14 of the Regional Plan are identified in Chapter 9 and Chapter 24. Specifically, the project has been designed to minimise the impact to water resources through the design of a robust water management system that separates clean water from water that will come into contact with disturbed areas.

In addition, based on the outcomes of the groundwater modelling, the extent of groundwater drawdown will be tight around the open cut void and will remain within the mine project area. The project is also consistent with the actions identified in Direction 16 and 17 of the Regional Plan for the management of Aboriginal and non-Aboriginal heritage assets.

The cultural heritage assessment has been undertaken in consultation with registered Aboriginal parties, and the project will not impact any Aboriginal cultural heritage or historic heritage items deemed to be of high significance. The project's impacts on heritage assets are considered further in Chapters 15, 16, 28 and 29.

3.6.2 Strategic Regional Land Use Policy

The NSW Government released the Strategic Regional Land Use Policy (SRLUP) in 2012 to "provide greater protection for valuable agricultural land and better balance competing land uses". This was by "identifying and protecting strategic agricultural land, protecting valuable water resources and providing greater certainty for companies wanting to invest in mining and coal seam gas projects in regional NSW". The SRLUP provides a strategic framework and a range of initiatives to balance agriculture and resource development.

The SRLUP applies to mining proposals that are SSD under the Mining SEPP and require a new or extended mining lease under the NSW Mining Act. In such cases, applicants are required to obtain a gateway certificate or an SVC before lodging a development application. The McPhillamys Gold Project is a mining proposal that is State significant development which requires a new mining lease and so the SRLUP applies.

The type of certificate required depends on whether a proposed development is on strategic agricultural land as defined in the SRLUP. Strategic agricultural land falls into two categories; land with a rare combination of natural resources which make it particularly valuable for agriculture (known as biophysical strategic agricultural land (BSAL)), or land which is important to a significant and clustered industry such as wine making or horse breeding (known as critical industry clusters (CICs)).

Developments that are verified to be on strategic agricultural land are required to go through the gateway process and obtain a gateway certificate. Conversely, developments which are not on strategic agricultural land need to obtain an SVC, certifying that the land is not BSAL.

An SVC was issued for the project on 18 June 2019, confirming that land within Regis' proposed mining lease application area is not biophysical strategic agricultural land.

An AIS for the project is provided in Appendix I and summarised in Chapter 8.

3.6.3 NSW Aquifer Interference Policy

The AIP was released by the NSW government in September 2012 to address water licensing and the potential impacts of the aquifer interference activities within NSW. The AIP defines the regime for protecting and managing the impacts of aquifer interference activities on NSW's water resources and assist proponents to prepare necessary information for activities that may affect aquifers.

The AIP aims to:

- clarify water licence and impact assessment requirements for aquifer interference activities;
- ensure equitable water sharing among different types of water users;
- ensure that water taken by aquifer interference activities is properly licenced and accounted for in the water budget and water sharing arrangements; and
- enhance existing regulation, resulting in a comprehensive framework to protect the rights of all water users and the environment.

The AIP states that the activity must address minimal impact consideration for impacts on water table, water pressure and water quality. It requires that planning for measures if the actual impacts are greater than predicted, including making sure there is sufficient monitoring in place.

The AIP focuses on high risk activities such as mining, coal seam gas, sand and gravel extraction, construction dewatering, aquifer injection activities, and other activities that have the potential to contaminate groundwater or decrease aquifer storage and yields. Impacts on connected alluvial aquifers and surface water systems, as well as impacts to other water dependent assets, such as water supply bores and groundwater dependent ecosystems are also considered.

All water taken from a water source by an aquifer interference activity, regardless of its quality, is required to be accounted for within the long-term average extraction limit specified for that water source. The AIP states that separate approval is required (under section 91(3) of the WM Act) for aquifer interference activities to ensure that the amount of water taken from each water source does not exceed the extraction limit set in the WSP. The requirement to obtain an aquifer interference approval under Section 91(3) is triggered only when a proclamation has been made under Section 88A of the WM Act that the particular type of approval is required. To date, no proclamation has been made specifying that an aquifer interference approval is required in any part of NSW. In the meantime, the AIP sets the policy with respect to aquifer interference. DPI Water's assessment framework for aquifer interference is included (and completed) in Appendix B of the Groundwater Assessment (EMM 2019a) (refer to Appendix K of this EIS).

Where an aquifer interference activity results in the movement of adjacent, overlying or underlying water into the groundwater source separate aquifer licences are required for each of these sources for the predicted volume of impact. In this regard, Regis has secured 400 shares in the Lachlan Fold Belt Murray Darling Basin Groundwater Source to licence the predicted inflow into the open cut mine, which will commence within the first year of mining.

Based on the results of the numerical groundwater model of the mine development, the maximum volume required for licensing in the Lachlan Fold Belt Murray Daring Basin (MDB) Groundwater Source is predicted to be 890 ML/year in around year two. The peak is associated with higher permeability and storage within the saprock. In subsequent mining years (4-10), the mine water inflow rate is predicted to reduce and range between approximately 300 and 475 ML/year. The ongoing groundwater inflow to the pit void which will need to be accounted for by WALs post mining is 200 ML/yr. There are sufficient licence entitlements available in the Lachlan Fold Belt MDB Groundwater Source to account for this take. Regis will apply through controlled allocation for the remaining 490 ML of groundwater licence requirements, or will seek to purchase shares form the market, in order to secure a total required volume of 890 ML.

The AIP also requires that two years of baseline groundwater data be collected and incorporated into the impact assessment prior to lodging a DA. As described in Chapter 3 of the Groundwater Assessment (EMM 2019a), extensive baseline data has been collected for the project with, for example, groundwater levels monitored via a dedicated project groundwater monitoring network since December 2016, and groundwater quality since March 2017.

3.7 Commonwealth legislation

3.7.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides the legal basis to protect and manage internationally and nationally important flora, fauna, ecological communities, heritage places and water resources which are deemed to be matters of national environmental significance (MNES). MNES, as defined under the EPBC Act are:

- World Heritage properties;
- places listed on the National Heritage Register;
- wetlands of international significance listed under the Ramsar Convention;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining) and;
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, actions that will, or are likely to, have a significant impact on a MNES are deemed to be controlled actions and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially affect a MNES has to be referred to the Commonwealth Minister for determination as to whether it is a controlled action.

A proposed action was referred to the Commonwealth Minister in April 2019 and subsequently determined to be a controlled action on 28 May 2019. An assessment of potential impacts on MNES is provided in Chapter 8 of the Biodiversity Assessment Report for the mine development (refer to Appendix N) and summarised in Chapter 13.

As explained in Chapter 1, the pipeline development component of the project was not part of the proposed action referred to the Commonwealth Minister and, therefore, does not form part of the controlled action.

3.7.2 Native Title Act 1993

The Commonwealth *Native Title Act 1993* recognises and protects native title rights in Australia. It allows a native title determination application (native title claim) to be made for land or waters where native title has not been validly extinguished, for example, extinguished by the grant of freehold title to land.

Applications for compensation for extinguishment or impairment of native title rights can also be made. All native title claims are subjected to a registration test and will only be registered if claimants satisfy several conditions. A register of native title claims is maintained by the National Native Title Tribunal.

Proposed activities or development that may affect native title are called 'future acts'. Claimants whose native title claims have been registered have the right to negotiate about some future acts, including mining and granting of a mining lease over the land covered by their native title claim. Where a native title claim is not registered, a development can proceed through mediation and determination processes, though claimants will not be able to participate in future act negotiations.

There are currently no native title applications over the mine development project area. However, as described in Section 3.3.10 some Crown roads exist in the mine project area.

The pipeline corridor does not traverse any native title determinations. However, it traverses some areas of Crown land, including waterways and several State forests where native title may exist. The eastern portion of the corridor crosses into the Warrabinga-Wiradjuri #7 registered native title claim (Federal Court file no. NSD857/2017).

A final decision has not been made as to the approach ensuring that the creation of the pipeline tenure will be valid insofar as it affects native title. However, it is anticipated that the approach may vary according to the nature of the underlying land interest. For example, through the State forests, easements may be validated as being consistent with the existing forestry reservation (Subdivision J of the Native Title Act). Alternatively, pipeline tenure obtained under the Pipelines Act or the Mining Act would likely attract an objection/consultation process with registered native title claims in accordance with s24MD(6B) of the Native Title Act.

3.8 Summary of approval requirements

The following table contains a summary of the licences, approvals and permits that are likely to be required for the McPhillamys Gold Project.

Table 3.3 Summary of required licences approvals and permits

Legislation	Authorisation	Consent or approval authority
EP&A Act	Development consent Construction certificate required prior to construction of certain structures in the processing area. Occupation certificate required prior to use of certain buildings in the infrastructure area.	Minister for Planning and Public Spaces or IPC BSC or private certifier BSC or private certifier
Mining Act	Mining lease MOP for mining operations	DRG DRG/DPIE
POEO Act	EPL for mining and mineral processing	EPA
EPBC Act	Approval to undertake a controlled action	DoEE
Roads Act	Section 138 permit for the connection of the mine access road with the Mid Western Highway	BSC
WM Act	Water access licences	DPIE Water

Table 3.3 Summary of required licences approvals and permits

Legislation	Authorisation	Consent or approval authority
Water Act	Licensing of monitoring bores	DPIE Water
Forestry Act	Approval for the occupation of land within State Forest (pipeline)	Forestry Corporation of NSW
Dams Safety Act	Listing of the TSF as a prescribed dam	Dams Safety Committee
Work Health and Safety Act	Licensing of dangerous goods (e.g. diesel and ANFO magazine storage)	NSW WorkCover Authority
Local Government Act	Approval for carrying out sewerage work	BSC
Radiation Control Act 1990	Radiation management licence for density gauges	EPA

Chapter 4

Stakeholder engagement

REGIS RESOURCES LTD

4 Stakeholder engagement and issue identification

4.1 Introduction

This chapter provides an overview of stakeholder consultation and engagement activities undertaken for the project. It describes the engagement program and the issue identification process and risk assessments that have been carried out that have been incorporated into the project design, environmental assessments and mitigation measures.

4.2 Overview of engagement

Regis has been actively engaging with stakeholders since acquiring the exploration lease (EL 5760) for McPhillamys in 2012. Regis has identified stakeholders and subsequently built relationships with them, to inform stakeholders and to obtain feedback about the project. To achieve these goals, Regis prepared a stakeholder engagement and consultation plan (consultation plan) for the project. The overriding principles of the plan in guiding all consultation activities are as follows:

1. **Be First, and Be Honest -** Regis seek to become the trusted source of information regarding all aspects of the project and encourage communities to seek clarification about the project. Regis are committed to timely, honest and open disclosure of problems or risks posed by the project as well as positive impacts.

2. **Be Fair, and Be Seen to be Fair –** Regis are committed to minimising the negative impacts of the project on local communities through effective community consultation. Regis will take a fair, consistent and transparent approach to all community consultation, property acquisition and impact mitigation negotiations, and complaints management.

3. **Value Add –** Regis are committed to contributing to community development by working in and with community groups, supporting cultural heritage and educational institutions, and contributing to community infrastructure.

4. **Listen and Learn –** Regis are committed to respecting the right of individuals and groups within communities to be consulted on the decisions we make which will potentially impact upon them. Regis will engage with the community in an empathetic, respectful and transparent manner.

The plan sets out who, how, why and when various stakeholders are to be engaged. Each of these aspects are described in the sub-sections below. The plan assisted Regis in planning, implementing and reviewing stakeholder engagement actions throughout the project planning phase and preparation of this EIS, and will continue to do so during the response to submissions and implementation phases.

Information gathered through the consultation process has been used to identify and assess potential issues, opportunities, risks and concerns, and to help develop a community profile. It has been instrumental in learning what is important to people in the local community and profiling their socio-economic conditions, aspirations, fears and perceptions about the project. This information has been used to inform the project’s planning and assessment process, and to develop well-targeted mitigation and management measures.

4.3 Consultation requirements

One objective of the EP&A Act is "to provide increased opportunity for public involvement and participation in environmental planning and assessment". Accordingly, stakeholder engagement and consultation has been an important part of the preparation of this EIS. The EARs for the project state that consultation with stakeholders must be undertaken, specifically stating:

> During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, Registered Aboriginal Parties (RAPs), affected landowners, and holders of existing mining and exploration authorities intersected by the proposed pipeline corridor. You must also establish a Community Consultative Committee for the project in accordance with the *Community Consultative Committee Guidelines for State Significant Projects,* and consult with the committee during the preparation of the EIS.
>
> The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.

Since obtaining licences to conduct exploration for the project site, there has been ongoing consultation and identification of stakeholders which has allowed Regis to identify and assess potential issues, opportunities, risks and concerns for the community and other key stakeholders. Regis has actively consulted with relevant statutory authorities, local landowners, local businesses, residents and community groups, Aboriginal stakeholders, infrastructure and service providers and other relevant stakeholders such as Centennial and Energy Australia.

A Community Consultation Committee (CCC) was established for the project following DPIE's issuing of the EARs in August 2018. The CCC has facilitated opportunities for increased community participation in the project and the further development of productive working relationships between Regis and the local community and stakeholder groups.

4.4 Stakeholder engagement process

4.4.1 Stakeholder identification and assessment

The objective of the stakeholder identification process was to identify, as far as reasonably practicable, those stakeholders deemed to hold a direct or indirect interest in the development of the project. In identifying stakeholders and developing a stakeholder register, Regis considered the range of government stakeholders, relevant local communities including their varied occupations, interests, community infrastructure or services that could be potentially impacted by the development of the project, as well as any regional interests such as media outlets or special interest groups.

The project's stakeholder register was regularly updated as additional stakeholders were identified or project configuration and design evolved.

The broad statutory and community groups that have been identified by Regis as stakeholders were:

- Near neighbours – those residing in proximity to the project area. The properties of these stakeholders are identified as sensitive receptors or sensitive receivers for the purposes of the respective impact assessments;
- Community – local businesses and industry groups, special interest groups, cultural heritage groups, service providers, non-government and not-for-profit organisations; training, education and health providers and media outlets; and

- Government – Local Councils, State and Commonwealth agencies, local, State and Federal members and Ministers.

Once stakeholders were identified, their relationships and areas of interest or concern as they pertain to the project and its perceived/potential impacts or benefits were established and assessed. This allowed Regis to define stakeholder engagement strategies tailored to individual or group needs at appropriate times throughout the evolution and environmental assessment of the project.

4.4.2 Stakeholder engagement tools

Engagement techniques and the level of involvement ranged from information dissemination and consultation, to involvement and collaboration on aspects such as community investment programs and development of mitigation measures.

A summary of the consultation tools used by Regis is provided in Table 4.1 and how they were used for the broad stakeholder groups identified is summarised in Table 4.2. A range of formal and informal stakeholder engagement tools were used, including phone calls, meetings, community information sessions, and project community information sheets. Regis also has a dedicated project website which provides project updates, answers to frequently asked questions and access to CCC meeting minutes and members' contact details as well as access to media releases and community information sheets.

Regis has established a project office in Blayney where interested people have been able to speak directly with Regis' personnel. This team comprises one full-time and one part-time community liaison officers who are responsible for responding to all queries and meeting requests related to the project. The remaining project team also make themselves available to respond to community queries as required.

Table 4.1 Consultation tools

Item	Summary
Project website: https://www.mcphillamysgold.com/	Regis has a dedicated project website that provides information about the project, environmental matters and local engagement initiatives. Community information sheets, copies of media releases, CCC minutes, frequently asked questions and copies of key documents are available on the website, as well as links for people to provide feedback or subscribe to further information. The objective of the website is to make information available 24/7 in a format that is easily accessible.
Regis Resources NSW Head office 57 Adelaide Street Blayney NSW 2799 (02) 6368 4100	Community members are able to speak directly with Regis' community liaison team or project technical staff by phone or face-to-face at the office which is located on the main street of Blayney. The office also provides access to community information sheets and other consultation materials. Consultation is documented in the project's community consultation register.
Project email address	Regis has a dedicated email addresses that provide contact points for stakeholders: NSW_Enquiries@regisresources.com.

Table 4.1 Consultation tools

Item	Summary
Information sessions	Regis has held community information sessions during the project planning phase to provide information about the project and its environmental studies to members of the community. They were held in Blayney between 2018 and 2019. The most recent community open days involved the technical air, noise, social, visual, water and TSF design specialists preparing the environmental assessments for the EIS. These technical specialists were available to discuss the project with community members and address questions and/or concerns. Community information sessions are also scheduled to occur during the EIS exhibition period. Technical specialists will also be available at these open days to answer questions regarding the respective technical assessments.
Community consultative committee	A CCC has been set up for the project (in accordance with the EARs). The CCC includes residents, business people, community groups (including representatives from the Belubula Headwaters Protection Group), Regis and the Councils of Blayney, Bathurst and Cabonne. The Committee has an independent Chairman, David Johnson, appointed by DPIE. The community consultation committee consists of: • six community members, including Kings Plains residents, • representative from Belubula Headwaters Protection Group; • representative from Orange and Regional Water Security Alliance Inc; • representatives from Bathurst, Blayney and Cabonne Councils; and • three Regis representatives. The CCC generally meets every two months and minutes from these meeting are published in the project website.
Community meeting	A Community meeting that was independently chaired by the CCC Chair was held at the Blayney Community Centre on 23 May 2019.
Information stands	Regis has run information stands at numerous events. These include farmers markets, Blayney Show as well as the Cadia Valley Operations open days.
Briefing and representation	Regis has provided project briefings to interested stakeholder groups and individuals, including local businesses and industry groups, members of parliament and statutory authorities. Regis are also actively involved in the local business community, including sponsoring the Orange Business Chamber and Blayney Rotary Club. Regis has also provided many briefings to individuals who are both supporters and non -supporters of the project.
Face to face meetings	Regis has held face to face meetings with landowners adjacent to the mine development since 2012 and landowners within or adjacent to the pipeline corridor since 2017.
Communication materials	Regis has published six community information sheets which have been distributed to the near neighbours and more recently the broader community. Copies are made available at the Blayney office and on the web site. The community information sheets are also emailed to email subscribers. The objective of the community information sheets is to ensure a flow of information to the community and provide contact details for feedback and enquiries.
Media communications	Project information has been communicated through media releases, local newspaper publications and radio segments. Regis in the lead up to the submitting the project application, has published fortnightly project updates in the Blayney Chronicle which provide project updates and respond to key community concerns regarding the project.

Table 4.2 Stakeholders and engagement activities

Stakeholders	Engagement activities
Landholders and local residents	• Face-to-face meetings; • Community information sheets; • Email and phone correspondence; • Community information sessions; • Independently chaired community information meeting; • Information stands; and • Representation on the CCC.
Local businesses and industry groups	• Project briefings; • Participation in local business groups and organisations; • Face-to-face meetings; • Email and phone correspondence; • Community information sessions; • Independently chaired community information meeting; and • Sponsorship and donations.
Special interest groups	• Project briefings; • Face-to-face meetings; • Email and phone correspondence; • Representation of the CCC; • Community information sessions; and • Townhall meeting.
Cultural heritage groups	• Face-to-face meetings; • Participation; • Email and phone correspondence; • Briefing sessions; and • Community information sessions.
Service providers (utilities, education, health, emergency services)	• Face-to-face meetings; • Briefing sessions; • Email and phone correspondence; and • Community information sessions.
Media groups and outlets	• Media statements, releases and advertising; • Radio and face-to-face interviews; • Email and phone correspondence; • Community information sessions; and • Townhall meeting.
Government agencies	• Project briefings; • Face-to-face meetings; and • Email and phone correspondence.
State and Federal political members	• Project briefings; • Face-to-face meetings; and • Email and phone correspondence.

Table 4.2 Stakeholders and engagement activities

Stakeholders	Engagement activities
Local government (including the mayor, councillors and council officers)	• Face-to-face meetings; • Project briefings; • Email and phone correspondence; • Community information sessions; and • Townhall meeting.

4.5 Near neighbour and community stakeholder issues and responses

The following near neighbour and community stakeholders have been identified and subsequently consulted with during the project development:

- near neighbours including rural residential landowners in the Kings Plains locality and along Guyong Road. Rural dwellings and agricultural enterprises including apiary, equine, grazing and a plant nursery;
- landholders whose properties are traversed by the pipeline corridor (as well as landholders along previous pipeline corridor alignment options);
- Community and specialist groups including;
  - Blayney Rotary Club;
  - Blayney NSW Farmers;
  - Blayney A & P Association;
  - Blayney Town Association;
  - Blayney Men's Shed;
  - Environmentally Concerned Citizens of Orange;
  - Belubula Headwaters Protection Group;
  - Orange and Regional Water Security Alliance Inc;
  - Neville Regional Landcare Group;
  - Orange PCYC;
  - Orange 360 (tourism peak body)
- Kings Plains Rural Fire Service;
- Orange Local Aboriginal Land Council and other representatives of the local Aboriginal Community. Engagement undertaken with Registered Aboriginal Parties for the mine development and pipeline development has been captured through the Cultural Heritage Assessment process (refer Appendix P and Z); and

- holders of existing mining and exploration authorities intersected by the pipeline development, mine project area and biodiversity offset site.

A number of issues were raised by these stakeholders during the stakeholder engagement process. These issues are presented in Table 4.3 alongside where they are addressed in the EIS. Table 4.3 also captures issues raised during the CCC process.

Table 4.3 Community stakeholder issues

Issues raised	Where addressed
Noise and blasting	
Concern roads will be closed during blasting	Chapter 10 & Appendix L
Concern regarding potential impact on horses from blasting	Chapters 8 &10 & Appendices I and L
Blasting notification	Chapter 10 & Appendix L
Noise impacts of the mine development	Chapter 10 & Appendix L
Air quality	
Potential for dust from the tailings dam	Chapter 11 & Appendix M
Dust impacts on rain water tanks	Chapter 11 & Appendix M
Potential for naturally occurring asbestos	Chapter 7 & 11
Pipeline water supply	
Water quality of pipeline water supply	Chapter 24 & Appendix X
Groundwater	
Impacts on groundwater resources (neighbouring bores)	Chapter 9 & Appendix K
Groundwater inflow to the pit	Chapter 9 & Appendix K
Impacts on springs	Chapter 9 & Appendix K
Surface water	
Impacts on surface water resources for downstream users	Chapter 9 & Appendix J
Surface water management	Chapter 9 & Appendix J
Reduced flows into Carcoar Dam	Chapter 9 & Appendix J
Tailings Dam	
TSF location on the Belubula	Chapters 2,6, 9 and Appendix D
Leakage/seepage from dam	Chapters 2,9 & Appendix D
Tailings composition	Chapter 2 & Appendix D
Overflows from TSF	Chapters 2 & 9 and Appendix D
Potential for TSF failure	Chapter 2 & Appendix D
Mining	
Waste rock characteristics	Chapter 2
Energy use	Chapter 11
Use of Cyanide	

Table 4.3 Community stakeholder issues

Issues raised	Where addressed
Cyanide use and management	Chapters 2 & 18 and Appendix CC
Landscape character and visual	
Change to rural character and amenity of Blayney township and Kings Plains locality	Chapter 20 & Appendix T
Visual impacts of mine on Mid-Western Highway	Chapter 19 & Appendix S
Impacts of lighting on amenity and 'dark sky'	Chapter 19 & Appendix S
Impacts on visual amenity	Chapter 19 & Appendix S
Agriculture	
Potential impacts on local apiary industry	Chapter 8 & Appendix I
Blasting impacts on local equine industry	Chapters 8 & 10 and Appendix L & I
Potential loss of agricultural land	Chapter 8 & Appendix I
Agriculture impacts during pipeline construction	Chapter 33
Property and land use	
Concern over potential impacts to land value	Appendix T
Property acquisition for pipeline development	Chapter 2
Rehabilitation on private land following pipeline construction	Chapter 35
Social	
Concern regarding uncertainty of whether the project will proceed	Chapter 20 & Appendix T
Impact on shift work arrangements on community through reduced sport/volunteering participation	Chapter 20 & Appendix T
Impacts on community life and sense of place	Chapter 20 & Appendix T
Employment opportunities	Chapter 20 & Appendix T
Source and residential location of workers	Chapter 20 & Appendix T
Health impacts	Chapters 11 & 20 and Appendix M & T
Tourism impacts	Chapter 20 & Appendix T
Impacts on housing	Chapter 20 & Appendix T
Economic benefits of the project	Chapter 20 & 36 and Appendix T & DD
Biodiversity	
Vegetation removal	Chapter 13 & Appendix N
Traffic	
Potential for significantly increased traffic	Chapter 17 & Appendix Q
Transport of hazardous goods	Chapter 18 & Appendix R
Closure and rehabilitation	
Legacy of mine	Chapter 22 & Appendix U

4.6 Government

All levels of government were consulted and engaged during the preparation of this EIS to identify key issues for consideration and seek guidance on assessment approaches and government policies that apply to the project. Consultation has been primarily through face-to-face or telephone meetings and briefings.

Table 4.4 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EIS reference
Government			
Blayney Shire Council	Project update	Mine plan	Chapter 2
	Social	Social fabric of Kings Plains	Chapter 20
		Potential property acquisition due to VLAMP	Chapter 10 & 20
		Local employment	Chapter 20
		TAFE -training opportunities	Chapter 20
		VPA	Chapter 20
	Traffic and Transport	Potential impacts and possible road upgrade requirements	Chapter 17
		Closure or realignment of Dungeon Road	Chapter 17
		New site access	Chapter 17
	Traffic and transport – pipeline development	Local traffic and access issues and preferred vehicle routes	Chapter 30
Cabonne Council	Project update	Mine plan	Chapter 2
	Traffic and transport – pipeline development	Local traffic and access issues and preferred vehicle routes	Chapter 30
	Environmental impact	Noise, air, social and water impacts of mine development	Part D
	Historic Heritage (Hallwood farm complex)	Council noted Hallwood had not been identified during community based heritage study in 2006	Chapter 16
	Water supply	Western coal fields water supply	Chapter 2 and Part E
	Social	Community consultation	Chapters 4 and 20
Lithgow City Council	Project briefing	Pipeline development	Chapter 2
	Pipeline development	Alignment of pipeline corridor	
	Water	Water quality of pipeline water	Chapter 24 and Appendix X
	Traffic and transport	Potential impacts and possible road upgrade requirements for Council Roads	Chapter 30
Bathurst Regional Council	Infrastructure locations – Pipeline development	Pipeline route alignment and location of pumping station facility No. 4 at Bathurst Bike Park	Chapter 2

Table 4.4 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EIS reference
Government			
	Traffic and Transport – Pipeline development	Potential traffic impacts from pumping station facility No. 4 at Bathurst Bike Park. Local traffic and access issues and preferred vehicle routes	Chapter 30
	Noise and Vibration - Pipeline development	Potential noise impacts from pumping station facility No. 4 at Bathurst Bike Park	Chapter 25
	Visual Amenity- Pipeline development	Potential visual amenity impacts from pumping station facility No. 4 at Bathurst Bike Park	Chapter 32
	Biodiversity – Pipeline development	Roadside vegetation and Purple Copper wing Butterfly habitat	Chapter 27
	Historic heritage	Heritage sites near pipeline corridor	Chapter 29
	Property	Access agreements for pipeline corridor	Chapter 2
Orange City Council (OCC)	Project update	Mine plan	Chapter 2
	Water	Consultation regarding OCC's long term water strategy and potential for pipeline development to benefit Central West Region in the long term	Chapters 6 & 35
Cowra Shire Council	Project briefing	Project overview	Chapter 2
	Pipeline development	Water source	Chapter 2
	Water	Water management	Chapter 9
		Water licensing	Chapter 9
	TSF	Tailings disposal	Chapter 2
	Cyanide	Use of cyanide	Chapter 2 & 6
NSW Department of Planning, Industry & Environment	Project updates	Regis has met regularly with DPIE since 2017.	
	Biodiversity	Transitional arrangements	
	EPBC referral	Controlled Action	Chapters 3 & 13
	SVC	BSAL and SVC	Chapters 3 & 7
	Social	Scope of SIA for mine development vs pipeline development	Chapters 20 & 33
		Employment numbers	Chapters 2, 20 & 33
		Community consultation	This chapter & 20
	Noise	Impacts on Kings Plains	Chapter 10
	Air Quality	Impacts on Kings Plains	Chapter 11
	TSF	Location on the Belubula	Chapter 2 & 6
	Water	Impacts on the Belubula	

Table 4.4 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EIS reference
Government			
		Water licensing	
NSW Environment Protection Authority (EPA)	TSF	Liner/seepage	Chapters 2 & 9
		Tailings characterisation	Chapter 2 & 9
		Tailing disposal method	Chapter 2,6 & 9
		TSF location	Chapter 2 & 6
	Noise	Noise impacts on Kings Plains	Chapter 10
	Air quality	Air quality impacts on Kings Plains	Chapter 11
Resources and geosciences	Closure	Final landform	Chapter 22
NSW Department of Planning, Industry and Environment. Biodiversity and Conservation Division (BCD)	Project update	Project status	-
	Aboriginal Heritage	Consultation with Orange LALC	Chapter 15
		Aboriginal heritage assessment	Chapter 15
	Biodiversity	Plant community types	Chapter 13
	Heritage pipeline	Avoidance of cultural heritage	Chapter 28 & 29
	Flooding	Confirmation of assessment requirements	Chapter 9
NSW Department of Primary Industry (DPI)s - Forestry	Pipeline corridor	Pipeline corridor alignment within forestry lands	Chapter 2 & 6
	Aboriginal and Cultural– Pipeline development	Cultural and heritage surveys on NSW Forestry land	Chapters 28 & 29
	Biodiversity - Pipeline development	Biodiversity surveys on NSW Forestry Land	Chapter 27
NSW Department of Primary Industry Fisheries (DPI Fisheries)	Project overview	Mine plan	Chapter 2
	Aquatic ecology	Impacts to key fish habitat in and downstream of mine project area	Chapter 14
		Aquatic ecology offsets	Chapter 14
NSW Department of Planning, Industry and environment-Division of Water (DPIE Water-formally DoI Water)	TSF	Location on the Belubula	Chapter 2 & 6
	Water	Water licensing	Chapter 9
	Pipeline development	Salinity of water supply	Chapter 24
NSW Department of Planning, Industry and Environment Lands Division (DPIE Lands – formally DoI Lands	Crown Lands	Status of crown land within the project area	Chapter 5
		Arrangements to acquire crown roads	Chapter 3
NSW Department of Premier and Cabinet	Project update	EIS consultation	Chapter 4
	Water	Surface water licensing	Chapter 9

Table 4.4 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EIS reference
Government			
NSW Department of Premier and Cabinet, Heritage, Community Engagement	Historic Heritage (Hallwood Farm Complex	Discussion of potential historic heritage significance of Hallwood Farm Complex and recommendations for further investigations	Chapter 16
NSW Roads and Maritime Services	Traffic and transport	Traffic and access issues on RMS controlled land.	Chapter 17 & 30
	New site access on Mid-Western Highway	Concept design/location	Chapter 17
		Use of fog warning lights	Chapter 17
Resources Regulator	Conceptual Project Development Plan (CPDP)	CPDP Meeting and site visit	-
Metalliferous Industry Safety Advisory Committee (MISAC)	MISAC meetings (held every 6 months)	Regis provides regular updates on the project	NA
Office of Donald Harwin Minister for Resources (former)	Project briefing	Mine development overview	-
Office of Paul Toole, State Member for Bathurst	Project update	Mine plan	Chapter 2 & Part D
		Pipeline development	Chapter 2 & Part E
	Community perception	Community consultation outcomes	Chapter 4
Office of Rick Colless Parliamentary Secretary for Western NSW (former)	Project update	Mine plan	Chapter 2
		TSF	Chapter 2, 9
		CIL processing	Chapters 2, 6, 18
		Near neighbours	Chapter 5 & Chapter 20
Office of Philip Donato, NSW Member for Orange	Project briefing	Mine development overview	-
	Economics	Economic benefits for Central West	Chapter 36
Office of Andrew Gee, Federal Member for Calare	Project update	Mine plan	Chapter 2
	Social	Community structure of Kings Plains	Chapter 20
		Employment	Chapter 20
	Amenity	Amenity impacts Kings Plains	Chapters 10,11 &19
	TSF	Location and design of TSF	Chapter 2 & 6
		Water impacts of TSF	Chapter 9
		CIL processing	Chapter 2,6 &18
		Cyanide management	Chapters 2 & 18
Service providers			
TransGrid	Pipeline development	Pipeline corridor alignment	Chapter 2
Essential Energy	Power supply	Power supply and power easement	Chapter 2
AGL	Pipeline development	Pipeline corridor alignment	Chapter 2
NSW Police Service	Project briefing	Project overview	-

Table 4.4 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EIS reference
Government			
NSW TAFE	Training opportunities	Introduction to mining course	Chapter 20
	Employment/sponsorship	Potential training or sponsorship opportunities	Chapter 20
Blayney Shire Local Emergency Management Committee	Participation	Regis is represented on this committee by Tony McPaul (NSW Manager Special Projects	-

4.7 Indigenous stakeholder consultation

Consultation with Aboriginal stakeholders began in 2013 as part of the mine development's drilling program and from 2016 as part of the mine development's Aboriginal cultural heritage assessment. For the pipeline development, consultation with Aboriginal stakeholders began in2017. All Aboriginal stakeholder consultation has been undertaken in accordance with the Department of Environment, Climate Change and Water (DECCW – now OEH) (2010) *Aboriginal Cultural Heritage Consultation Requirements for Proponents*.

The outcomes of Aboriginal stakeholder consultation are documented in Chapter 15 and Appendix P for the mine development component of the project and Chapter 28 and Appendix Z for the pipeline development component of the project, including issues raised and mitigation measures proposed to address the issues.

4.8 Ongoing stakeholder consultation

As documented above, stakeholder engagement undertaken by Regis on the project has been comprehensive and reflects the requirements of the EARs.

Regis will continue to work closely with local government councils, particularly BSC, State and Commonwealth agencies, directly and indirectly affected landholders, the CCC, service providers, and the Blayney community to help inform the project final design and management to ensure the project meets the reasonable expectations of stakeholders.

Regis will continue to implement the consultation tools identified in Table 4.1. In particular, Regis will hold further community open days during the EIS exhibition phase and will continue to circulate community information sheets during the response to submission phase and independent planning commission phase of the project.

4.9 Issues prioritisation

Risk assessment workshops have been held at various times over the evolution of the project including most recently a TSF risk assessment workshop in March 2019 (Risk Mentor 2019b) (refer Section 2.9 and Appendix F) and a preliminary hazard analysis risk assessment workshop held in February 2019 (Risk Mentor 2019a) (refer Chapter 18 and Appendix R). General project risk assessments for the mine development and pipeline development were also carried out earlier in project development (Risk Mentor 2017a and Risk Mentor 2017b).

These risk assessments, together with extensive consultation with government agencies and other stakeholders, has enabled the identification and ranking of the projects potential environmental, social and economic impacts.

This has allowed the project's characteristics requiring assessment to be prioritised. Groundwater, surface water, noise, air quality, social and visual aspect of the project were all identified as high priority areas for project assessment.

An assessment of each project aspect has been undertaken as part of this EIS to a level of detail commensurate with the scale of the project, the existing features of the project area and surrounds, and the legislative framework under which the project is to be assessed and determined. Regis has already made substantial modifications to the project to avoid and minimise environmental impacts, as described in Chapter 6 (project evolution and alternatives), and has committed to a range of management measures, as detailed in Chapter 38 of this EIS.

Part C

Existing environment and project evolution

REGIS RESOURCES LTD

Chapter 5

Site and surrounds

5 Site and surrounds

5.1 Project location and character

5.1.1 Mine development

The mine development is in the Central Tablelands region of NSW, approximately 8 km north-east of Blayney, 20 km west of Bathurst, and 27 km south-east of Orange, as shown in Figure 1.2.

The mine project area is predominantly in the Blayney LGA, with a small portion in the north extending into the Cabonne LGA. The mine project area is zoned RU1 Primary Production under both the Blayney LEP and Cabonne LEP. The primary land use within the project area is agriculture, consisting of mostly cleared open paddocks utilised for cattle grazing and some limited cropping. Dungeon Road, an existing unsealed road, traverses the site.

Mining has a strong history in the Blayney LGA. Many of the towns of the Blayney LGA owe their existence and growth to the early gold mining industry and more recently Cadia Valley Operations (CVO). The existing character of Blayney is shaped not only by the agricultural setting and the heritage style buildings in town, but also by the Nestle Purina factory and existing quarries on the northern town access road and the industrial estate and showgrounds on the Mid Western Highway to the east.

The mine project area is surrounded by a variety of land uses, predominately agriculture, as well as scattered rural residences, forestry and natural areas. Historical gold mining activity in the project area, both within the alluvial deposits of the Belubula River and hard rock mining at several locations including the historical McPhillamys Mine on the "Ingledoon" property, was recorded between 1884 and 1967.

The mine project area is bounded by the Vittoria State Forest to the north-east and the Mid Western Highway to the south. The land immediately to the west and north predominantly comprise agricultural areas including scattered rural residences. The small settlement of Kings Plains also lies directly south of the mine project area, on the southern side of the Mid Western Highway. Kings Plains has an estimated resident population (ERP) of 60 people and consists of a combination of rural lifestyle blocks and larger rural landholdings (Hansen Bailey 2019).

Consistent with the mine project area, the broader region also comprises predominantly agricultural land. Other land uses in the region as noted above include resource extraction, industrial operations like cement manufacturing and the manufacturing of products such as pet food, honey and organic materials. Commercial operations in proximity to the mine project area include Waste to Resources (W2R) in Kings Plains, a composting facility producing bulk commercial product and landscape supplies approximately 580 m south-east of the project area. Drayshed Nursery is located at "Whim Park" on Kings Plains Road approximately 1 km south of the project area in the Kings Plains locality. The Beekeepers Inn is located to the far north of the project area on the Mitchell Highway.

Photograph 5.1 to Photograph 5.4 illustrate the character of the mine project area and its surrounds.

Photograph 5.1 View from the proposed open cut towards the south-east

Photograph 5.2 View from the proposed waste rock emplacement area towards the south

Photograph 5.3 View from the proposed waste rock emplacement towards the west

Photograph 5.4 View from the proposed waste rock emplacement towards the north-west

5.1.2 Pipeline development

The pipeline corridor traverses the LGAs of Lithgow, Bathurst and Blayney extending for approximately 90 km from Angus Place, SCSO and MPPS at its eastern extent in the Blue Mountains to the mine development at its western extent. The pipeline corridor is illustrated at a regional scale in Figure 1.1 while Figure 2.2 shows the local context along the pipeline corridor. Photographs 5.5 to 5.8 illustrate the character of the pipeline corridor and its surrounds.

As described in Chapter 2, the alignment of the pipeline has been carefully devised to utilise disturbed ground, such as existing road easements and tracks, as much as possible. The pipeline corridor primarily traverses land used for agriculture, comprising mostly cleared, open paddocks used for sheep and cattle grazing. The pipeline corridor also travels through the Vittoria State Forest, Sunny Corner State Forest and Ben Bullen State Forest and some areas of native woodland vegetation. At the eastern extent of the pipeline development, the corridor passes through disturbed land used for mining and power generation at Angus Place, SCSO and MPPS. The corridor also crosses a number of major highways; the Mid Western Highway, Great Western Highway and Castlereagh Highway.

Photograph 5.5 The Springvale water treatment plant at the eastern end of the pipeline development

Photograph 5.6 View of open farmland and rural dwelling along pipeline corridor

Photograph 5.7 Open woodland along the pipeline corridor

Photograph 5.8 Vittoria state forests (pine plantations) along the pipeline corridor

5.2 Biophysical factors

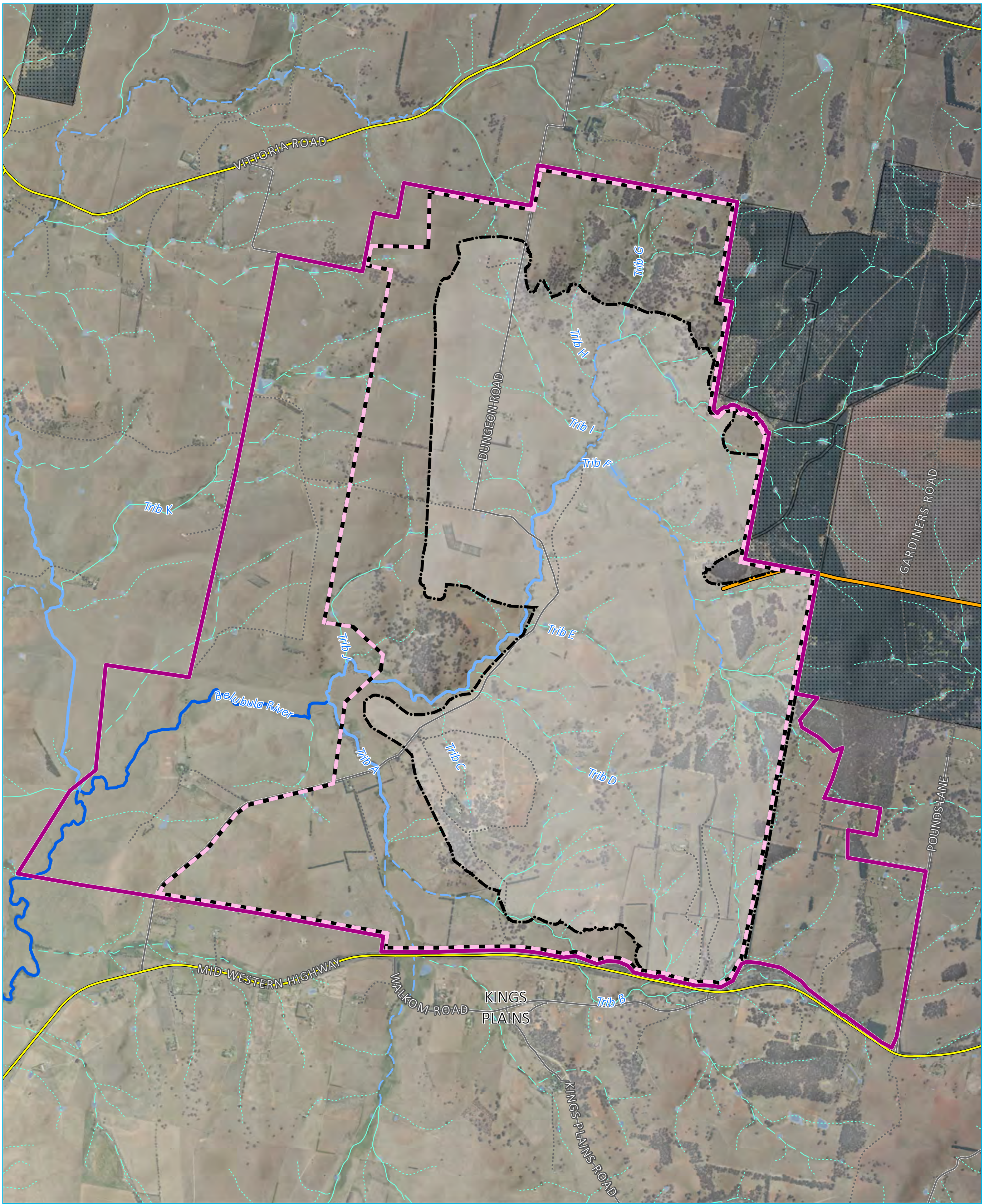
5.2.1 Mine development

i Water resources

The mine project area is in the upper reaches of the Belubula River catchment, which is part of the broader Lachlan River catchment and managed under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012* (Lachlan WSP). The Lachlan River is a major tributary within the Murray-Darling Basin, terminating in the Great Cumbung Swamp, near the banks of the Murrumbidgee River approximately 580 km south-west of the mine project area. The project area is within the Belubula River Upstream Carcoar Dam Unregulated River Water Source.

The Belubula River has its headwaters immediately north-east of the mine project area. The Belubula River flows south-west through the project area, which is traversed by several drainage lines that flow into the Belubula River (refer Figure 1.3). At the downstream end of the project area, the Belubula River is a sixth order stream with 10 main mapped tributaries. The Belubula River flows into Carcoar Dam, located approximately 26 km south-west of the project area. Carcoar Dam has a catchment area of approximately 23,000 ha in area and a storage capacity of approximately 35.8 gigalitres (GL). It is used primarily for regulated releases for environmental, mining, irrigation, stock and domestic purposes.

The hydrology of the project area is illustrated in Figure 5.1.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014); DPI (2013)

0 1 2 km

GDA 1994 MGA Zone 55

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

Existing environment

- Main road
- Local road
- Vehicular track
- Waterbody
- Vittoria State Forest

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Hydrology of the project area

McPhillamys Gold Project
Environmental impact statement
Figure 5.1

ii Biodiversity

The majority of the mine project area has been subject to previous and current agricultural use and primarily comprises cleared open paddocks with fragmented patches of timbered natural vegetation and open grasslands. Grasslands are varied in condition and quality and include some exotic plant species. Native grasses include Kangaroo Grass (*Themeda triandra*), Red-anthered Wallaby Grass (*Rytidosperma pallidum*) and Weeping Grass (*Microlaena stipoides*). Patches of native grass cover are small and rapidly change over tens of metres to exotic dominated pasture.

The mine project area is in the South Eastern Highlands Bioregion under the Interim Biogeographic Regionalisation of Australia (IBRA). Native plant community types (PCTs) recorded in the project area during field surveys conducted for the biodiversity assessment for the mine development include:

- Blakely's Red Gum Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion;
- Broad-leaved Peppermint – Brittle Gum – Red Stringybark dry open forest of the South Eastern Highlands Bioregion;
- Mountain Gum – Manna Gum open forest of the South Eastern Highlands Bioregion; and
- Carex sedgeland of the slopes and tablelands.

One PCT, Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, represents White Box Yellow Box Blakely's Red Gum Woodland, which is listed as an endangered ecological community (EEC) under the BC Act. Patches of this PCT that are in moderate/good (high) and moderate/good (medium) condition also meet the criteria for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, listed as a critically endangered ecological community (CEEC) under the EPBC Act.

Envirokey has undertaken several field surveys of the mine project area since 2013, with a total of 62 native and 42 exotic species recorded. Field surveys completed by EMM in 2019 identified 32 native and 27 exotic species. No threatened flora species have been recorded during field surveys in the project area. No groundwater dependent ecosystems (GDEs) are predicted to occur within the project area, as discussed further in Chapter14.

Two threatened fauna species have been recorded in the mine project area during field surveys: Squirrel Glider *(Petaurus norfolcensis)* and Koala (*Phascolarctos cinereus*).

iii Climate

The project area experiences a temperate climate with no dry season and warm summers, as classified by the Koppen climate classification system. This consists of warm summers and cold winters.

The Blayney (Orange Road) Bureau of Meteorology (BOM) weather station is 8 km south-west of the project area. Between 1991 and 2018, the average annual rainfall was 815.6 mm. No temperature data is available from this weather station.

Regis operates a weather station and temperature gauge, both located near the southern boundary of the mine project area near the Mid Western Highway.

iv Soils and topography

The mine project area is located on the western slopes of the Great Dividing Range and comprises an undulating landscape with elevations between 872.43 m Australian height datum (AHD) and 1,017.82 m AHD, with open valley floors between the hills generally less than 100 m wide (refer to Figure 5.2 and Figure 5.3).

In the south-west corner of the mine project area, there is lower topographic relief and decreasing elevation along the Belubula River floodplain. Two soil landscape units have been mapped in the mine project area by Kovac et al (1989) including the Vittoria-Blayney Soil Landscape and the Macquarie Soil Landscape. The Vittoria-Blayney Soil Landscape is associated with an elevated and undulating landscape and the Macquarie Soil Landscape is associated with the floodplains of the Belubula River.

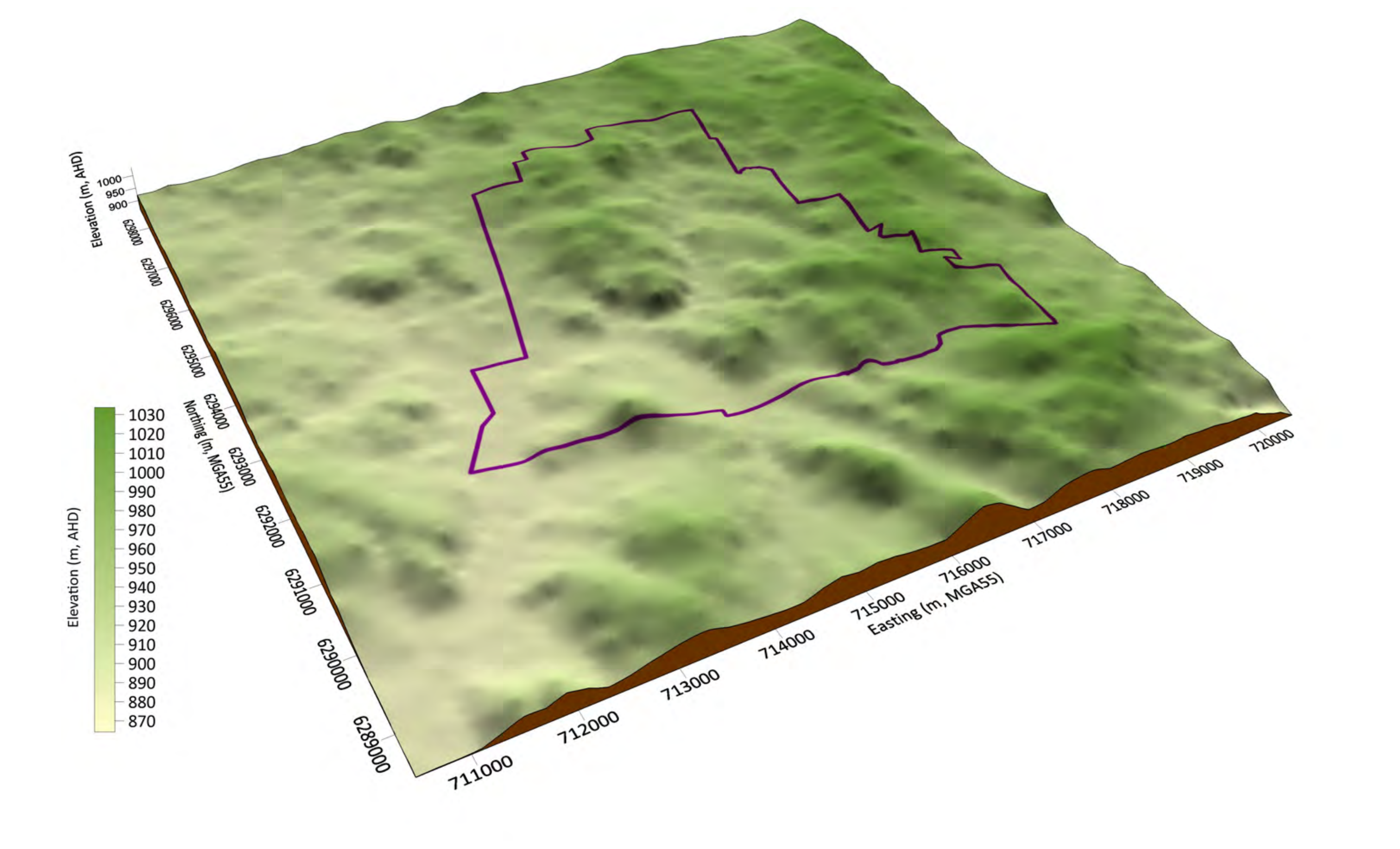
The following significant topographic features are located within proximity to the mine project area:

- Mount Canobolas – 1,390 m AHD and approximately 34 km north-east of the project area;
- Crackerjack Rock – 967 m AHD and approximately 10 km north-east of the project area; and
- Mount Macquarie – 1,204 m AHD and approximately 21 km south-west of the project area.

v Geology

The geology of the mine project area generally ages from east to west and is part of the eastern sub province of the Lachlan Fold Belt. The mine project area is mostly underlain by the Silurian aged Anson Formation which is dominated by siltstone with layers of conglomerate, sandstone, limestone and volcaniclastic rock. The Devonian aged Cunningham Formation is near the eastern boundary of the mine project area and consists of slate with thin sandstone and conglomerate layers. The Ordovician aged Byng Volcanics and Blayney Volcanics are near the western boundary of the mine project area and is characteristic of basalt and andesite with phenocrysts in a dark green matrix. Floodplains of the Belubula River consists of Quaternary aged alluvium.

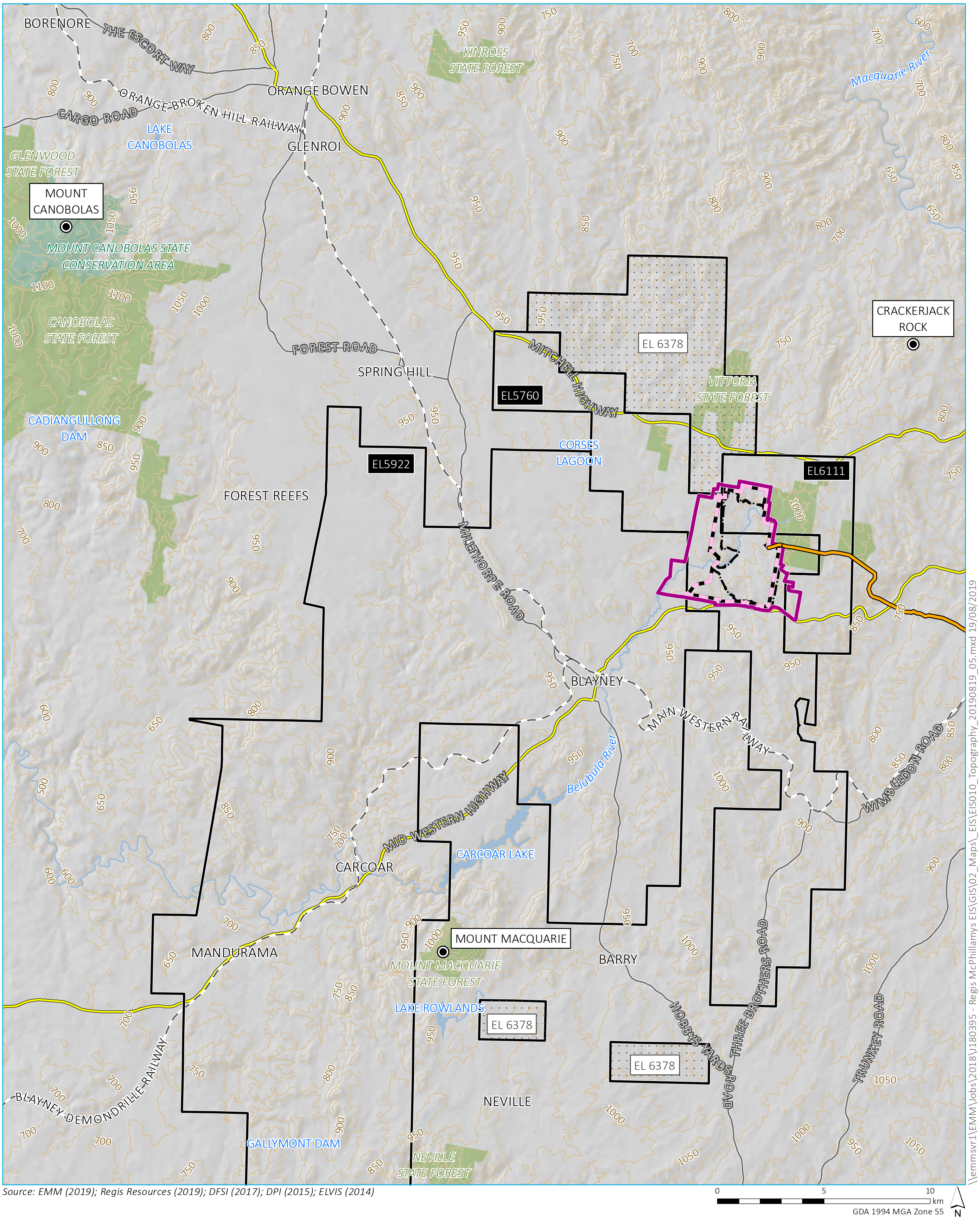
The target gold deposit of the mine development is in volcaniclastic rock of the Anson Formation and occurs on the eastern side of the Sherlock Fault, part of the Godolphin-Copperhania thrust fault zone. It is located on one of a series of north-south trending horsetail faulting structures that occur at the inflection of the Godolphin-Copperhania Fault Zone, where the orientation changes from north-west and south-east to south-west and north-east. The faulting structures are defined by strong shearing and continue south for over 6 km.



3-Dimensional topography of project area and surrounds

McPhillamys Gold Project
Environmental impact statement

Figure 5.2



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Exploration lease boundaries (of interest)

- Held by LFB Resources NL (Regis)
- Held by others

Existing environment

- Rail line
- Primary road
- Arterial road
- Contour (50 m)
- River
- Waterbody
- NPWS reserve
- State forest

Topography of the mine project area and surrounds

McPhillamys Gold Project
Environmental impact statement
Figure 5.3

REGIS RESOURCES LTD

EMM creating opportunities

5.2.2 Pipeline development

i Water resources

The pipeline corridor crosses 112 creeks and drainage lines. Most of these are ephemeral minor streams and gullies that only flow after large rainfall events. Eight of the drainage lines are associated with perennial watercourses being:

- Coxs River;
- Wangcol Creek;
- Pipers Flat Creek;
- Salt Water Creek;
- Macquarie River;
- Queen Charlottes Creek (Vale Creek)
- Evans Plains Creek; and
- McLeans Creek.

As noted in Chapter 2, mine discharge water from Angus Place contributes to flow in the Coxs River at the location where the pipeline corridor will cross. Discharges from Angus Place to the Coxs River will cease by 31 December 2019, after which this portion of the Coxs River is expected to experience lower flows.

ii Biodiversity

The pipeline is located primarily along cleared agricultural land used for grazing and cropping and plantations of Monterey Pine (*Pinus radiata)* within state forests. Where it occurs along the pipeline corridor, native vegetation generally consists of paddock trees and open woodlands. Exotic pasture occurs along the pipeline length.

In total 253 plant species were recorded during the field surveys conducted for the biodiversity assessment for the pipeline development. This includes 83 non-native plant species, consisting of mostly grasses and forbs, of which 14 are high threat weed species, including four species listed under the NSW *Biosecurity Act 2015* as priority weeds for the Central Tablelands Local Land Services Region. The pipeline corridor traverses the northern section of the South Eastern Highlands IBRA Bioregion, including the Bathurst, Capertee Uplands, Hill End and Orange sub-regions. These sub-regions are characterised by a variety of landforms.

Thirteen native PCTs were recorded in the pipeline corridor during field surveys. Of these, two are listed Threatened Ecological Communities as follows:

- White Box Yellow Box Blakely's Red Gum Woodland - a listed EEC under the NSW BC Act; and
- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Grassland - a CEEC listed under the EPBC Act.

The pipeline corridor has been carefully aligned to avoid native vegetation as much as possible, as described in Chapter 6 and Chapter 27.

iii Climate

The climate slightly varies over the extent of the pipeline corridor. Like the mine project area, the extent of the pipeline corridor experiences a temperate climate with no dry season and hot summers, as classified by the Koppen climate classification system.

There is a Bureau of Meteorology (BOM) weather station at Bathurst Airport, which is 2.5 km south of the pipeline corridor near Bathurst. Between 1991 and 2019, the average maximum temperature was 20.4°c and average minimum temperature 6.9°c. Between 1994 and 2019, the average annual rainfall was 603.9 mm.

The Lithgow (Cooerwull) BOM weather station is 3 km south-west of Angus Place Colliery. This is the closest BOM weather station to the eastern most point of the pipeline. Between 2006 and 2019, the average maximum temperature was 19.5°c and average minimum temperature 17.6°c. Between 1959 and 2019, the average annual rainfall was 758 mm.

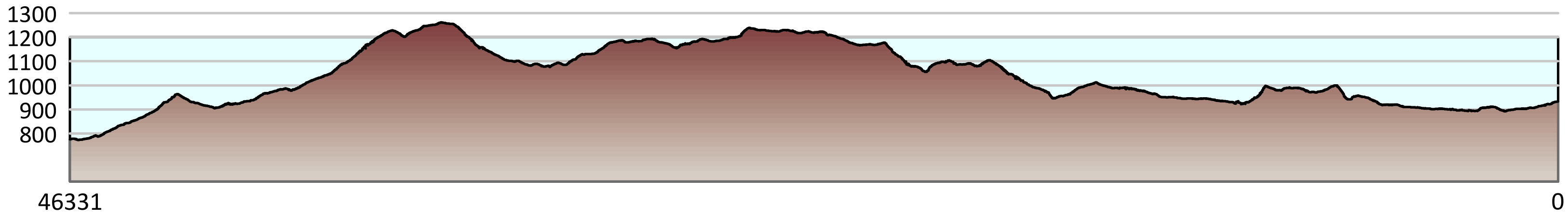
iv Soils and topography

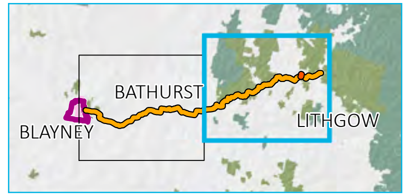
The South Eastern Highlands Bioregion is comprised of the plateaus and dissected ranges of the Great Dividing Range, which is bound by the Great Escarpment to the east and slopes of the abutting inland drainage basins to the west. The sub regions of the South Eastern Highlands Bioregion relevant to the pipeline corridor include:

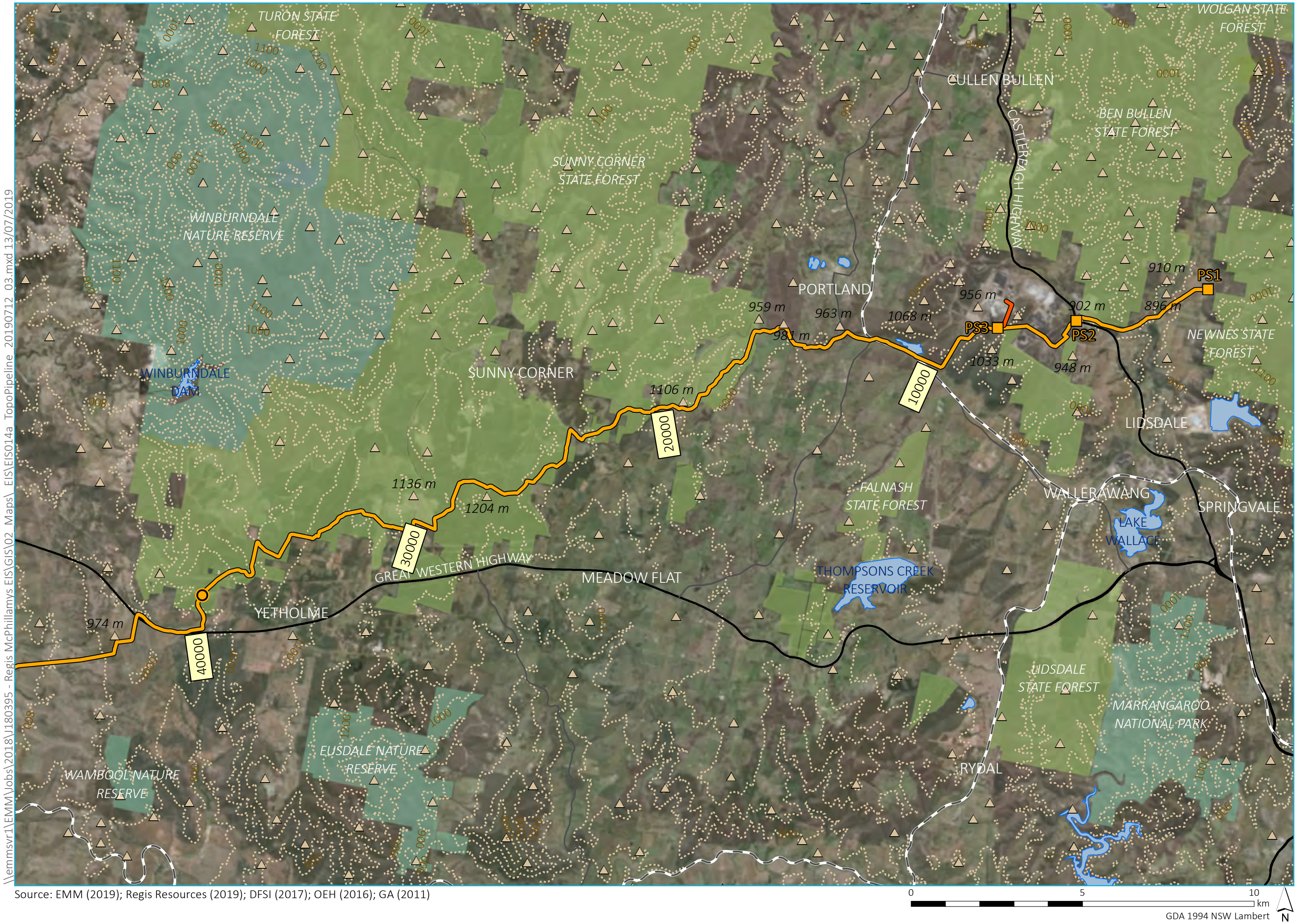
- Bathurst sub region – rounded hills in a granite basin with steep slopes;
- Capertee Uplands sub region – wide valleys and low rolling hills;
- Hill End sub region – plateaus of hilly and mountainous slopes; and
- Orange sub region – low hills and hilly plateaus with numerous volcanic features;

The topography along the pipeline corridor includes some steep woodland sections, undulating land, and some flat areas associated with watercourses or the top of slopes. As shown in Figures 5.4a and 5.4b, elevation ranges from approximately 1,000 m above sea level (ASL) near MPPS, the Portland cemetery and Burkes Road; generally between 1,000 to 1,200 m ASL (up to 1,265 m ASL) through the Sunny Corner State Forest; dropping towards the Great Western Highway to about 1,050 m ASL; then falling gradually to about 650 m ASL at the Macquarie River. The land rises reasonably steeply to approximately 750 m ASL at the Orton Park pumping station facility No. 4 and then undulates between 750 m and 800 m ASL to Evans Plains Creek and the Mid Western Highway. There is a steep climb up Fitzgeralds Mount to 900 m and a gentle rise to 1,000 m ASL to the mine site.

The pipeline corridor is located within the Mitchell Landscapes of Capertee Plateau, Newnes Plateau, Upper Macquarie Channels and Floodplains, Mount Horrible Plateau, Macquarie Valley Basalts, Bathurst Granites and Rockley Plains. It traverses multiple soil landscapes, including Lithgow, Cullen Bullen, Capertee, Sunny Corner, Yetholme, Mookerawa, Vittoria Blayney, Raglan and Bathurst.







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Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2016); GA (2011)

KEY

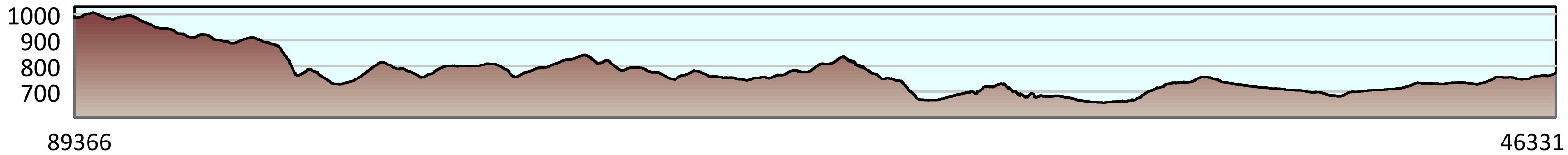
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

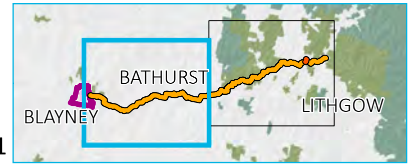
Existing environment

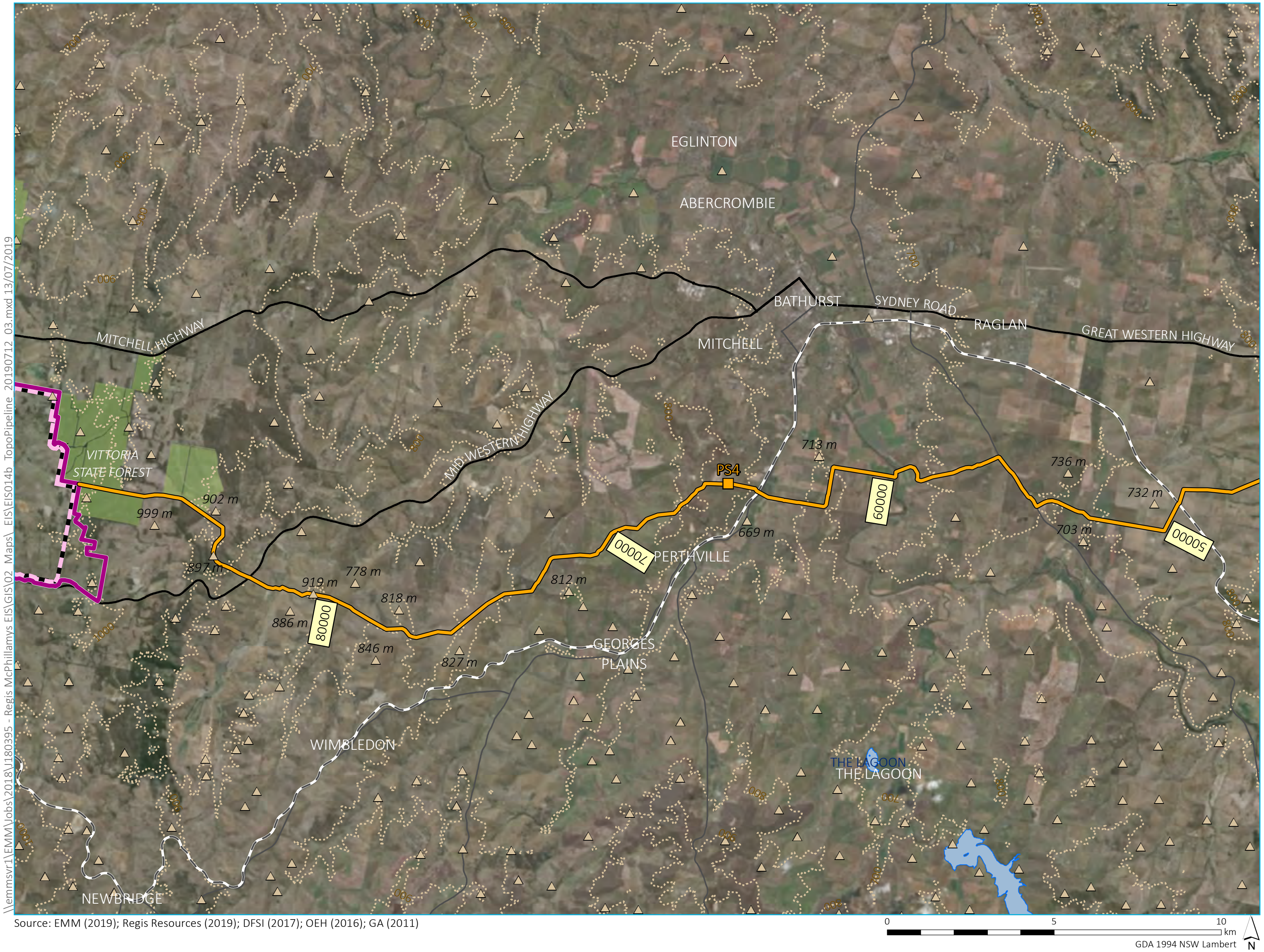
- Rail line
- Primary road
- Arterial road
- Waterbody
- Spot height
- Contour (100 m)
- NPWS reserve
- State forest

Topography of the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 5.4a







KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- Waterbody
- Spot height
- Contour (100 m)
- NPWS reserve
- State forest

Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2016); GA (2011)

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Topography of the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 5.4b

5.3 Land ownership

5.3.1 Mine development

The mine project area covers approximately 2,513 ha, all of which is either owned by Regis or under option for purchase by Regis, apart from small areas of crown land (predominately crown road reserves) as shown in Figure 5.4. The mine project area is mostly surrounded by freehold land apart from the Vittoria State Forest, which is adjacent to the project area on the eastern side and is operated by the Forestry Corporation of NSW. There is also a small parcel of Crown land adjacent to the project area to the south of the Vittoria State Forest. The Mid Western Highway, owned by the NSW State Government, bounds the mine project area to the south.

Regis has negotiated an "option deed to purchase" for another parcel of land (Lot 1 DP 1054966) situated between the Mid Western Highway and the southern boundary of the mine project area.

There are 88 sensitive receivers within proximity to the mine project area, comprising privately owned rural dwellings (refer Figure 5.5).

5.3.2 Pipeline development

The pipeline corridor utilises existing road reserves and easements to minimise the need for excessive clearing or easement acquisition over private land. The corridor traverses across land owned by 28 stakeholders. Lithgow, Bathurst and Blayney Councils, Centennial, EA and land operated by Forestry Corporation of NSW are the major land owners. The pipeline corridor also crosses 19 privately owned properties. Access agreements are in place between Regis and these landholders. Crown land, crown roads and NSW State forest area along the pipeline are shown the detailed pipeline corridor overview contained in Appendix V.

5.4 Surrounding land uses

5.4.1 Mine development

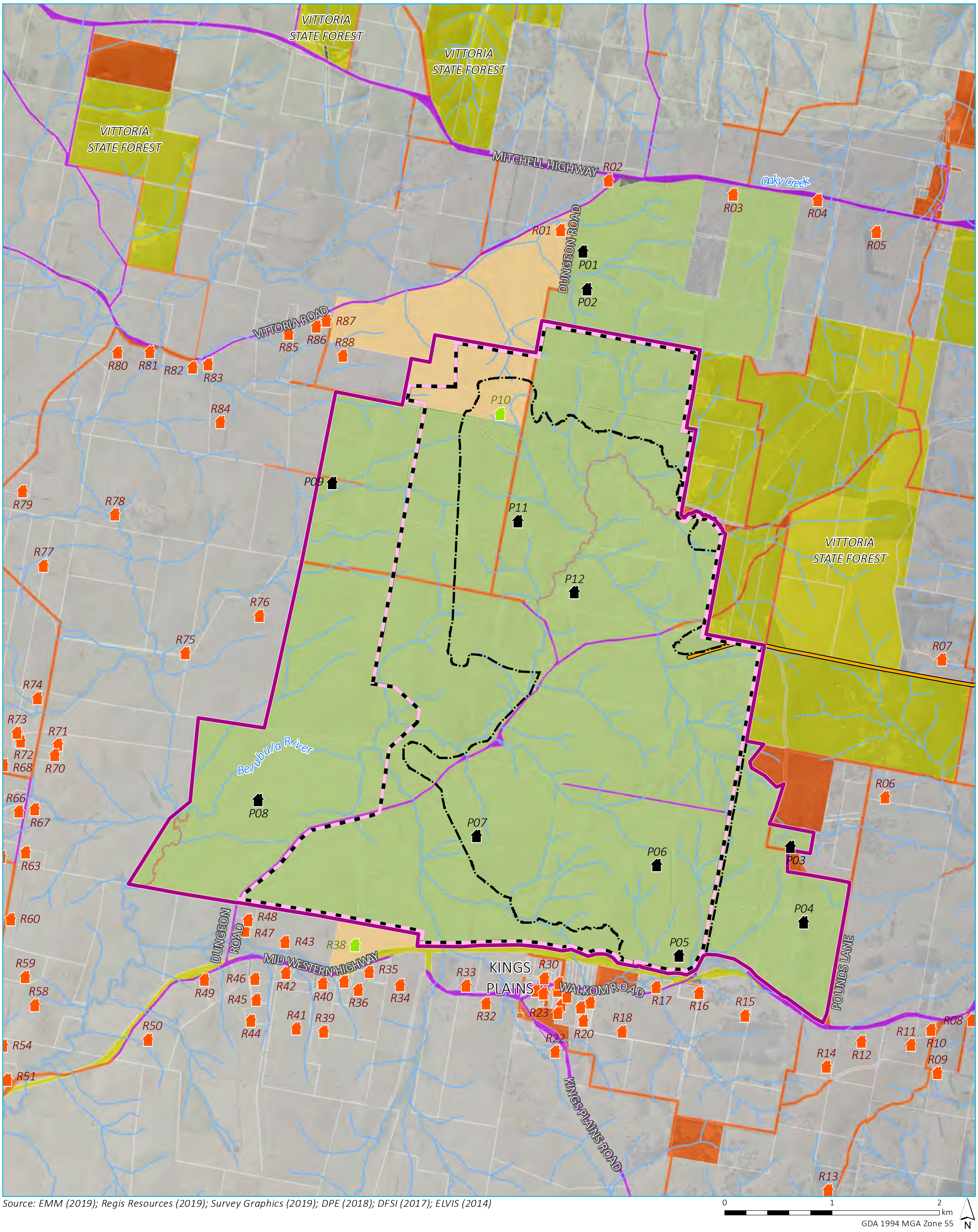
Land uses in the vicinity of the mine development are illustrated in Figure 5.6 and summarised in the following sub-sections.

i Agriculture

As noted in Section 5.2.1, the mine project area has been subject to historical agricultural use and consists of primarily cleared open paddocks utilised for cattle grazing and cropping. This land use is consistent with the surrounding area, where agriculture is also the primary land use.

Agricultural and primary production industries in the surrounding area include viticulture and apiculture (bee keeping). An alpaca stud farm is located approximately 3 km north-west of the mine project area. Cottesbrook Honey is located on Kellys Road approximately 2 km south-east of the mine project area, and Goldfields Honey is produced at the Beekeepers Inn, approximately 3 km to the north-west. Numerous vineyards are located on the western and southern fringes of Orange, to the north-west of the mine project area.

More broadly across the Blayney LGA, agriculture accounts for 132,592 ha (88%) of the land use. The majority of agricultural business in the Shire graze beef cattle and sheep. A very small number of businesses are involved in production of dairy cattle, wine grapes or other horticultural enterprises. Further information on agricultural land use in the Blayney LGA and the mine project area is provided in Chapter 8.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); DFSI (2017); ELVIS (2014)

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KEY

- Sensitive receptors
- Residences under option
- Project-related residences

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Watercourse/drainage line

Land ownership status (Regis, 2019)

- Regis
- Under option

Controlling authority

- Crown
- Freehold
- Local government authority
- NSW government

Land tenure - mine development

McPhillamys Gold Project
Environmental impact statement
Figure 5.5

ii Natural resources

There are multiple fragments of the Vittoria State Forest, operated by the Forestry Corporation of NSW, surrounding the project area. A portion of the Vittoria State Forest adjoins the north-eastern boundary of the mine project area (refer Figure 1.3). This area is forested with pine plantations.

iii Rural residential development

The nearest townships to the mine project area are Blayney and Millthorpe, located 8 km south-west and 12 km north-west of the project area, respectively, in the Blayney LGA. The regional centres of Orange and Bathurst are located approximately 27 km north-west and approximately 20 km east of the project area, respectively (refer to Figure 1.2 in Chapter 1).

As illustrated in Figure 5.5 and described in Section 5.3.1, there are 88 privately owned houses within proximity to the mine project area, either on adjoining land or adjacent to the project area on the southern side of the Mid Western Highway. The Kings Plains locality is directly south of the project area. The majority of privately owned residences that are in close proximity to the mine project area are located in this locality.

There are nine mine-owned residences within the mine project area (refer Figure 5.5) and one (P10 on Figure 5.5) for which Regis has negotiated an option to purchase pending project approval with the landholder. Residences within the disturbance footprint will be demolished during mine development.

iv Tourism and recreation

As described above, there are multiple fragments of the Vittoria State Forest surrounding the mine project area. A portion is located to the north of the mine project area and north the Mitchell Highway and includes Macquarie Woods recreation area, approximately 4 km from the mine project area. This recreation area offers camping, picnic areas and facilities, walking tracks and lookouts. Blayney Tourist Park is located approximately 8.5 km south-west of the mine project area, which offers camping and cabin style accommodation.

A number of bed and breakfast style accommodation facilities are available in the region, particularly in the Millthorpe area. Examples of bed and breakfast accommodation include:

- Drayshed Cottage in Kings Plains – approximately 1 km south of the mine project area;
- Gleneagles Cottage and Cabin in Millthorpe – approximately 11 km north-west of the mine project area; and
- Godolphin Country Accommodation in Guyong – approximately 9.5 km north-west of the mine project area.

v Mining and industrial

There is a long history of mining in the Blayney region. Both gold and copper mining were widespread in the Blayney-Kings Plains district in the late 1800s to early 1900s.

In 1851, the first payable gold discovery was in Ophir by Hargraves, Tom and Lister, 17 km north-east of Orange. This find triggered the first gold rush in the region which continued for approximately 30 years. In the same year, the Lucknow goldfield was discovered 6 km south-east of Orange and mined at the Wentworth Mine.

A number of alluvial goldfields found along tributaries of the Belubula River were worked in the area surrounding the McPhillamys gold deposit in the 1850s and 60s.

Early hard rock mining at McPhillamys hill (the location of the proposed open cut pit) began in 1888 but was largely unsuccessful. Two shafts were sunk to 30 m and 35 m respectively and cross cuts were driven 34 m east and 29 m west through the mineralised zone, which reportedly intersected 21 gold bearing quartz veins (Roche 1888); however, no production or payable finds were reported. Mining at McPhillamys continued sporadically, in line with gold prices, over the following 50 years. The only reported production records are for 1894 where 6.2 oz of gold was extracted from 4 tonnes of ore. More recently, sporadic exploration for gold and other metals has occurred in the region since the mid-1960s.

Figure 5.8 illustrates locations of historic mining that has occurred within the mine project area.

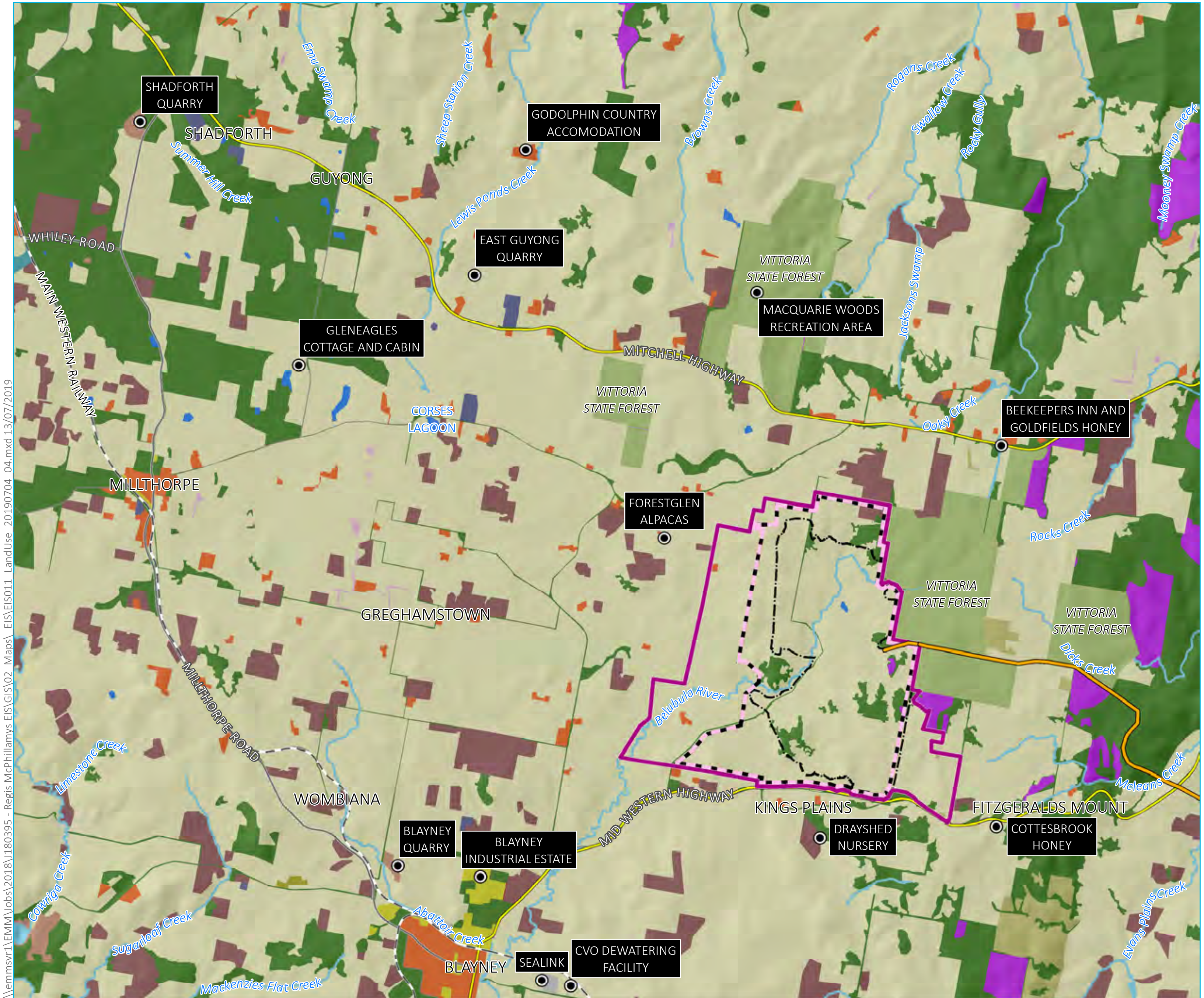
A number of existing mines operate in the broader region today (refer to Figure 5.7), including:

- Cadia Valley Operations (CVO) – owned and operated by Newcrest Mining Limited, the Cadia Valley Operations are approximately 27 km west of the mine project area, and 25 km south-west of Orange. Existing operations include the underground mining of gold and copper-gold concentrate as part of the Cadia East Project. Increased processing of 32 million tonnes per annum (Mtpa) was approved on 31 August 2015 for Cadia Hill Gold Mine. The Cadia Hill Gold Mine open cut has recently been approved for the deposition of tailings and Ridgeway Gold Mine is currently under care and maintenance.

- Northparkes Mine – owned and operated by China Molybdenum Co., Ltd and the Suntimo Groups, Northparkes Mine is in Parkes approximately 130 km north-west of the mine project area. The mine utilises the block cave mining technique for the extraction of copper and gold and received approval on 16 July 2014 to increase processing to 8.5 Mtpa.

- Cowal Gold Operation – owned and operated by Evolution Mining (Cowal) Pty Limited, Cowal Gold Operation is approximately 180 km south-east of the mine project area near Wyalong. Increased processing of 9.8 Mtpa was approved on 4 October 2018.

- Cow Flat Quarry - a limestone quarry approximately 21 km south-east of the McPhillamys mine project area. The MLs for this quarry are held by Omya Australia Pty Limited.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2013); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

KEY

- Land use points of interest

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Rail line
- Primary road
- Arterial road

Land use

- Managed resource protection
- Grazing native vegetation
- Production forestry
- Plantation forestry
- Grazing modified pastures
- Cropping
- Perennial horticulture
- Irrigated cropping
- Intensive animal husbandry
- Manufacturing and industrial
- Residential and farm infrastructure
- Services
- Transport and communication
- Mining
- Waste treatment and disposal
- Reservoir/dam
- River
- Other minimal use

Surrounding land uses

McPhillamys Gold Project
Environmental impact statement
Figure 5.6

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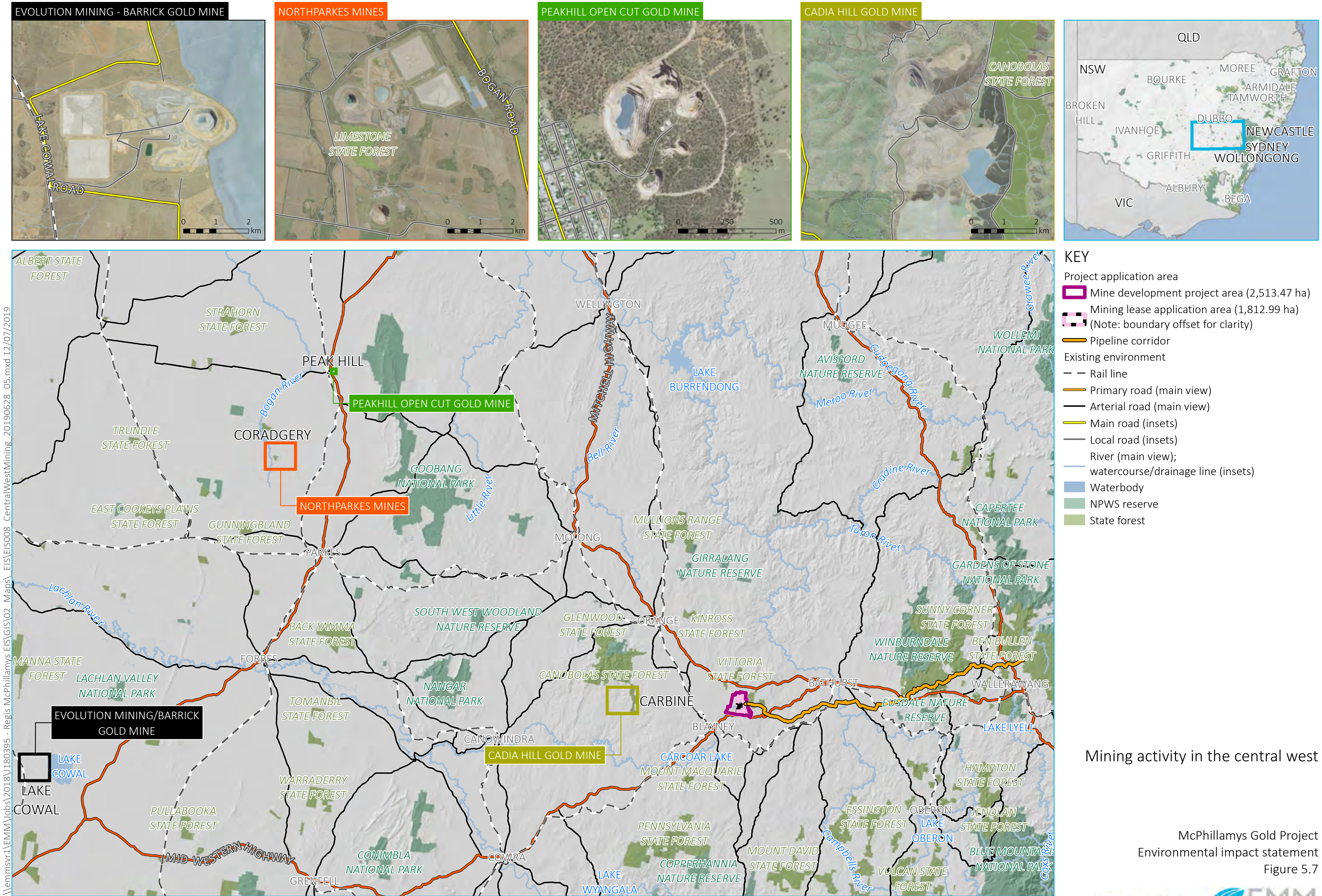
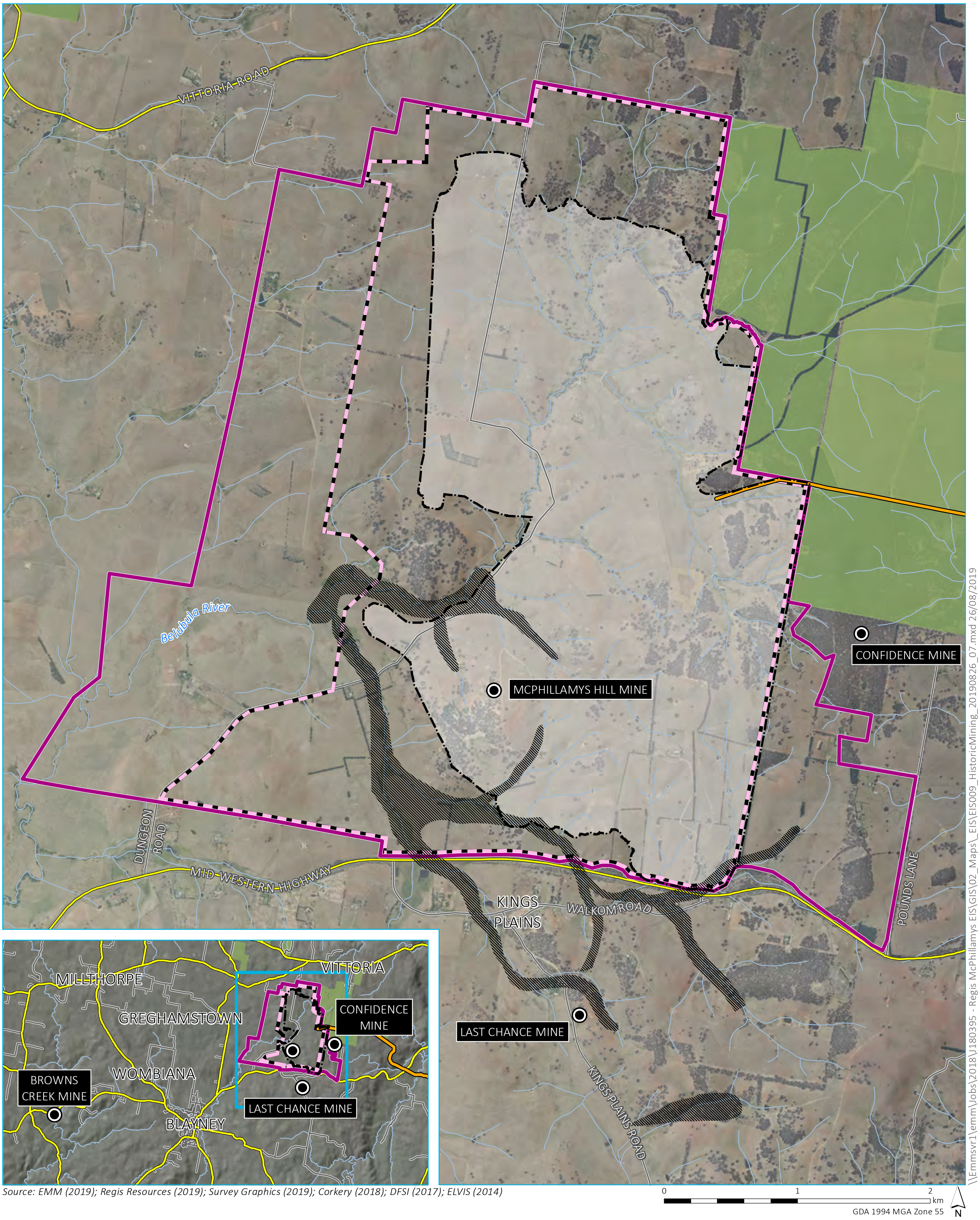


Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011); ASGC (2006)

Mining activity in the central west

McPhillamys Gold Project
Environmental impact statement
Figure 5.7



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); Corkery (2018); DFSI (2017); ELVIS (2014)

KEY

- Historical mine
- Historical mining area

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

Historical mining activity in the area

McPhillamys Gold Project
Environmental impact statement
Figure 5.8

Historical mining operations within the region are summarised below.

- McPhillamys Hill Mine early hard rock mining at McPhillamys hill began in 1888, but was largely unsuccessful. Two shafts were sunk to 30 m and 35 m respectively and cross cuts were driven 34 m east and 29 m west through the mineralised zone which reportedly intersected 21 gold bearing quartz veins (Roche, 1888), however no production or payable finds were reported. Mining at McPhillamys continued sporadically, in line with gold prices, over the next 50 years. The only reported production records are for 1894 where 6.2 oz of gold was extracted from 4 tonnes of ore.

- Confidence Mine – the historical mine operated between 1867 and 1888 and was located 0.6 km east of the mine project area. Confidence Mine targeted alluvial deposits utilising shafts and drives and produced approximately 6,400 ounces of gold (French et al 2013).

- Last Chance Mine – this historical mine operated was located approximately 1.2 km to the south of the mine project area and produced around 4,782 ounces between 1889–1905 (French et al 2013).

- Browns Creek Mine – mining was established in the Browns Creek area in the late 1860s. Since then various open cut and underground mining operations have been carried out at various times. The mine was closed in 1999 after the mine was flooded.

- Peak Hill Mine – the historical gold mine operated between 1917 and 1983 and produced 60,000-500,000 tonnes (t) of rock (Parkes Tourism n.d). It is in Peak Hill, approximately 100 km north-west of Orange. Alkane Exploration extracted further 4.9 Mt of rock from 1996 to 2005 (Alkane Exploration 2019). Alkane Exploration now operates the Peak Hill Open Cut Experience at Peak Hill Mine.

Other extractive industries in the region include:

- Blayney Quarry – Currently a small quarry at 12 Greghamstown Road, Blayney , approximately 3.5 km to the south-west of the mine project area. This quarry is currently seeking approval to increase extraction up to 250,000 tonnes per annum of material at an average rate of 150,000 tpa.

- East Guyong Quarry – a quarry operated by Hanson located on the Mitchell Highway in Guyong. It is approximately 22 km south-east of Orange and 36 km west of Bathurst. The quarry currently has approval to produce up to 400,000 tpa to 600,000 tpa of basalt quarry products.

- Shadforth Quarry – a quarry operated by Boral, located at Shadforth approximately 15 km to the north-west of the mine project area.

Industrial facilities within the region include cement manufacturing and the manufacturing of products such as pet food. Industrial facilities located in the region include:

- Australian Native Landscapes (ANL) – ANL’s site at Blayney and Long Hill is located on Browns Creek Road at the site of the historical Browns Creek Mine (see above), and receives organic material for the manufacturing of potting and soil mixes, mulch, compost and soil conditioners.

- Nestlé Purina Pet Care factory – is located just west of Blayney on Millthorpe Road and manufactures pet food for distribution to domestic and international markets.

- Midwest Concrete – located in the northern fringe of Blayney on Marshalls Lane in the Blayney Industrial Estate, Midwest Concrete commenced operation in 1985 and produces concrete products for sale such as feeding troughs and civil products for sale in NSW, Queensland and Victoria.

- SeaLink Cold Storage Warehouse – part of Blayney cold storage and distribution, Sealink is located at 139 Newbridge Road. The business which includes cold store warehouses and a rail siding supplies a range of food products to over 2000 trade customers daily throughout central and western NSW.

5.4.2 Pipeline development

Land uses in the vicinity of the pipeline corridor are illustrated in Figure 5.9 and summarised in the following sub-sections. Figure 5.9 also shows the location of sensitive receivers within 1 km of the corridor.

i Natural resources

As noted in Section 5.1.2, the pipeline corridor traverses the Vittoria State Forest, Sunny Corner State Forest and Ben Bullen State Forest (refer Figures 2.2). Newnes State Forest is immediately to the east of the start of the pipeline. There are areas of native vegetation, paddock trees and open woodlands, in the western part of the pipeline corridor and areas of native forests in the eastern part of the corridor at higher altitudes.

ii Agriculture

The majority of the pipeline corridor traverses cleared agricultural land, consisting of mostly cleared open paddocks utilised for cattle grazing and cropping. The most high value agricultural land is found around the Macquarie River and Queen Charlottes Creek.

iii Residential and recreation

There are 297 structures, mainly residential dwellings, within an area 1 km either side of the pipeline corridor. There are approximately 84 sensitive receivers within 200 m of the pipeline corridor, of which approximately 77 are residential. Approximately 21 of these are within 50 m or less from the pipeline corridor. The majority of these residential dwellings are located around the pipeline intersection with the Castlereagh Highway, southern Portland, the Great Western Highway, south Bathurst and Bathampton with closest sensitive receivers located around pumping station facility No.2, areas south of Portland, Sunny Corner Road near the Kirkconnell Correctional Centre, the Great Western Highway, Tarana Road, White Rock Road and Montavella Road.Some active recreation, the Bathurst Cycling Club and Bathurst Mountain Bike Club, are within 500 m of the pipeline corridor.

iv Infrastructure and utilities

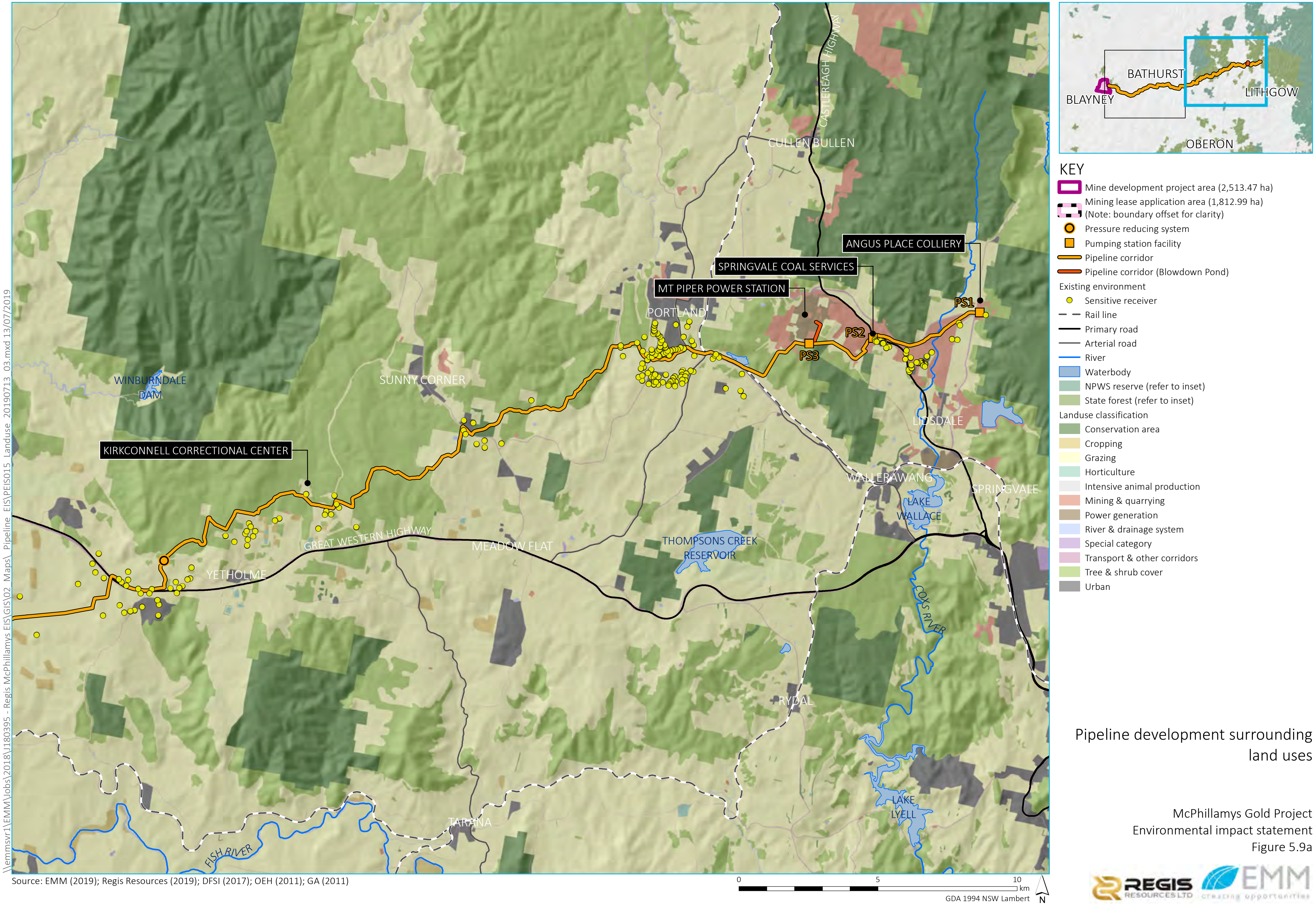
As described in Chapter 2, the pipeline corridor will primarily follow road reserves, including highways and State forest tracks, and existing power transmission lines and gas pipeline easements which travel east to west.

The pipeline corridor requires the crossing of six main roads and three railway lines being:

- Castlereagh Highway just north of SCSO;
- Great Western Highway at Walang;
- Mid Western Highway at the base of Fitzgeralds Mount;
- Pipers Flat Road;
- O'Connell Road;
- Vale Road;

- Wallerawang Gwabegar Railway Line near the intersection of Pipers Flat Road and Range Road;
- Main Western Railway Line between Brewongle Lane and Tarana Road; and
- Main Western Railway Line at Vale Road near Orton Park.

All of the above transport corridors will be under bored. In addition, the pipeline will cross the APA gas pipeline at several locations (underboring and gas crossing locations are shown on Figure 2.2a to 2.2h.)



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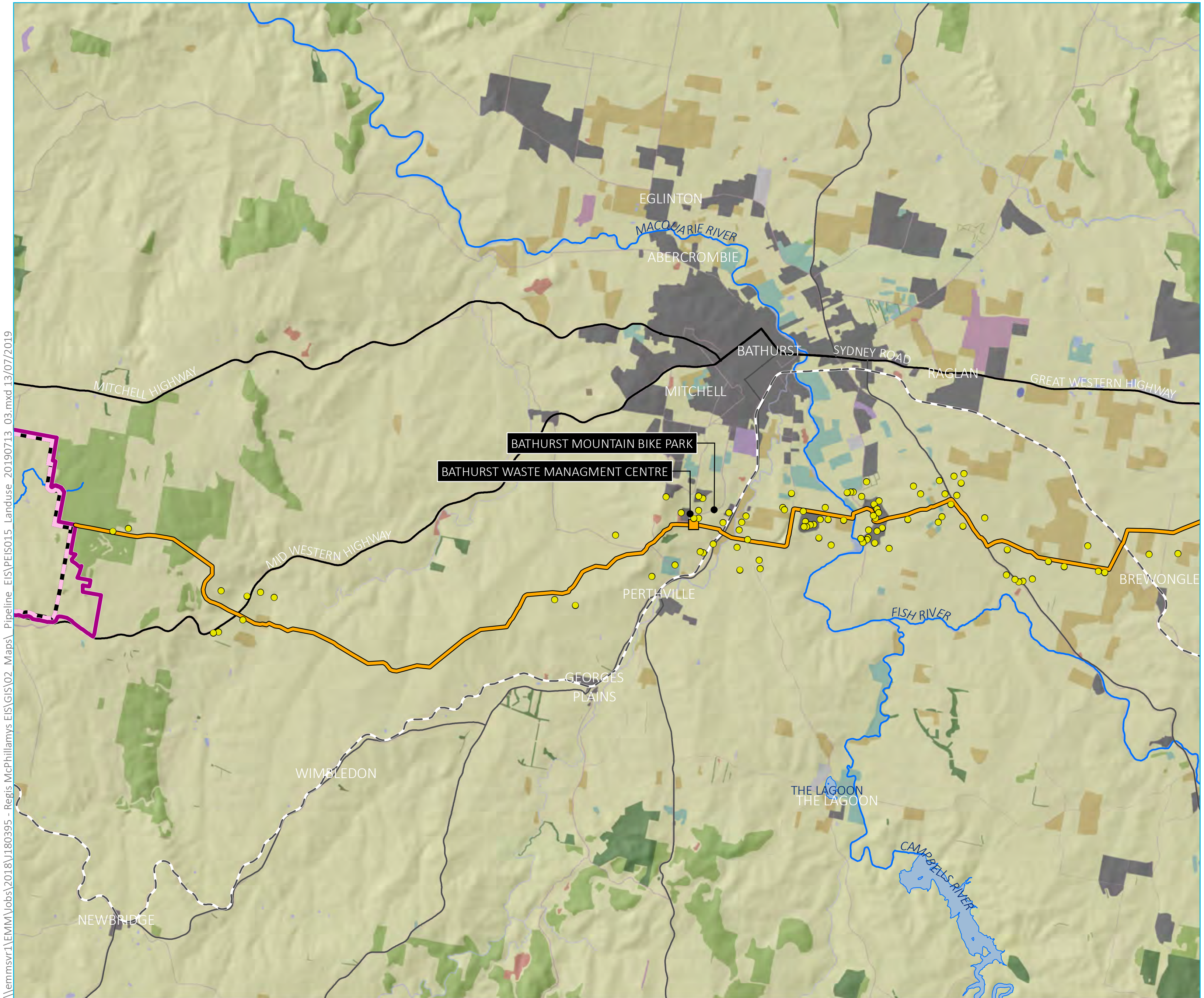
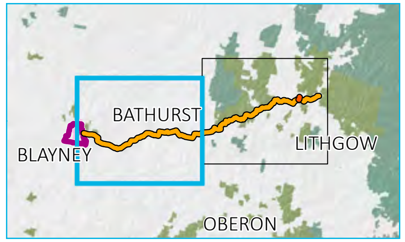
Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2011); GA (2011)

Pipeline development surrounding land uses

McPhillamys Gold Project
Environmental impact statement
Figure 5.9a





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Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2011); GA (2011)

KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment
- Sensitive receiver
- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Landuse classification
- Conservation area
- Cropping
- Grazing
- Horticulture
- Intensive animal production
- Mining & quarrying
- Power generation
- River & drainage system
- Special category
- Transport & other corridors
- Tree & shrub cover
- Urban
- Wetland

Pipeline development surrounding land uses

McPhillamys Gold Project
Environmental impact statement
Figure 5.9b

v Mining and industrial

Existing mining and industrial operations within the vicinity of the pipeline are described below.

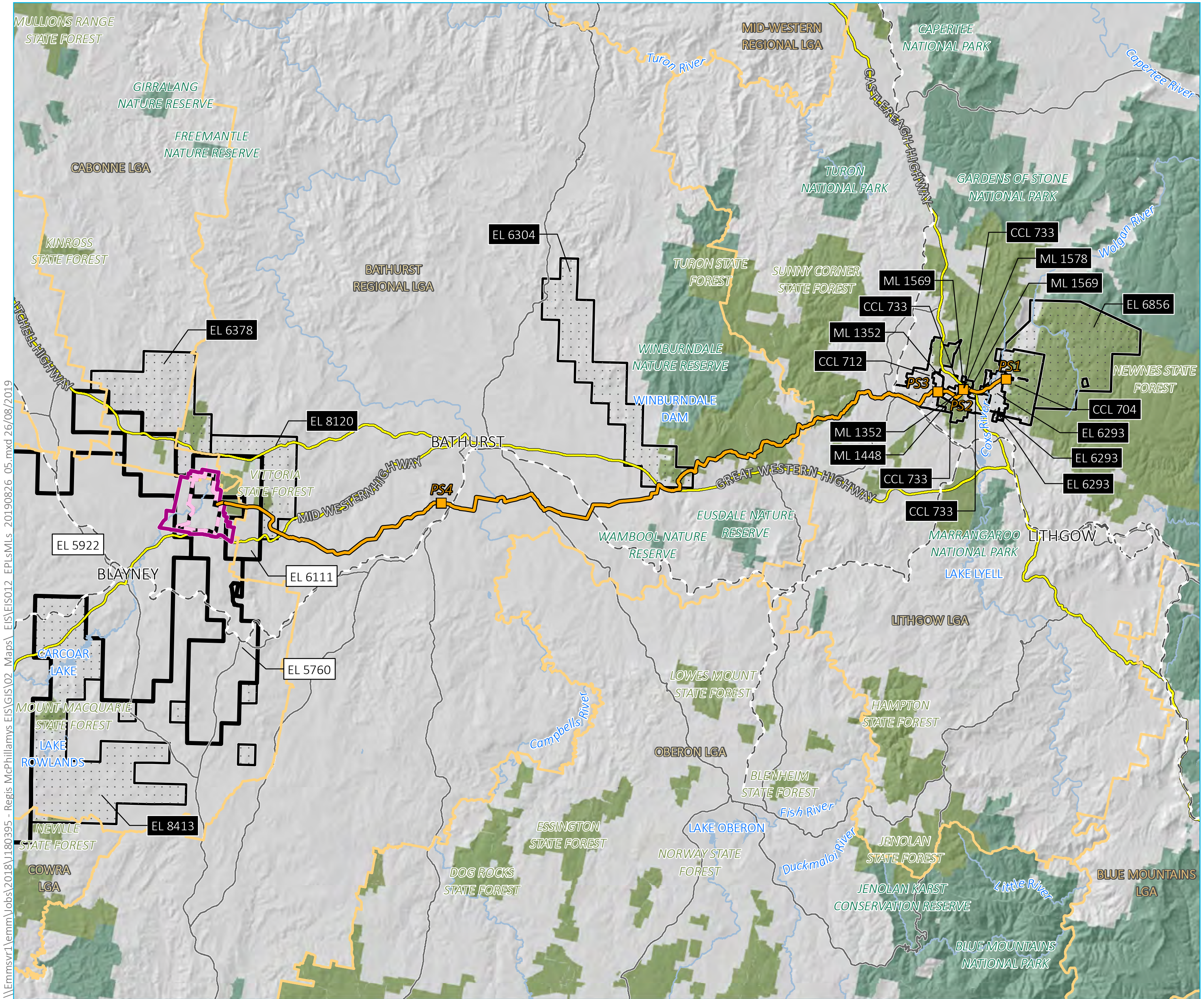
- Angus Place – located just north of Wallerawang and north-east of Lithgow, Angus Place is an underground coal mine utilising longwall and continuous miner techniques for the extraction of 4 Mtpa of coal (Centennial Coal 2019a). It is proposed that a pumping station at the eastern most point of the pipeline will be located within the boundary of Angus Place to transport water to the mine.

- SCSO – operated by Centennial Coal, the SCSO processes coal from Springvale Colliery and then transports coal to EA's MPPS and Centennial's Lidsdale Siding. It is located just north of Wallerawang and north-east of Lithgow. It is proposed that a pumping station connected to the pipeline will be located near the southern boundary of the SCSO to transport water to the mine.

- Springvale Colliery – operated by Centennial, Springvale Colliery is located near Lithgow and Wallerawang and approximately 6 km south of the pipelines most eastern point. It is an underground coal mine utilising longwall technique to extract 5.5 Mtpa of coal (Centennial Coal 2019c).

- Bathurst Waste Management Centre – the pipeline corridor traverses the Council's Bathurst Bike Park to the south of the Bathurst Waste Management Centre, which comprises a landfill depot and recycling centre.

The pipeline corridor also intersects the mining and exploration titles shown on Figure 5.10 along the pipeline corridor.



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Source: EMM (2019); Regis Resources (2019); DPE (2018); DFSI (2017); GA (2011)

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Pumping station facility

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest
- Local government area

Exploration lease boundaries (of interest)

- Held by LFB Resources NL (Regis)
- Held by others

Mining and exploration titles

McPhillamys Gold Project
Environmental impact statement
Figure 5.10

Chapter 6

Project evolution and alternatives

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6 Project evolution and alternatives

6.1 Introduction

This chapter describes the alternatives that were considered during the planning, design and environmental assessment of the project. The project described in Chapter 2 for which development consent is sought is the result of an iterative process undertaken to achieve a project design that will enable the efficient extraction of the resource, environmental protection and socio-economic benefits.

The key elements of the project where alternatives were considered include:

- extent of the mine project area and mining lease (ML) application area boundaries;
- site layout, including location of mine infrastructure areas and topsoil stockpile;
- waste rock emplacement, including;
  - the number and location of waste rock emplacements;
  - construction and emplacement schedule of the waste rock emplacement;
- gold extraction ore method;
- tailings storage facility, including:
  - tailings disposal method;
  - tailings detoxification method;
  - location and design of the tailings storage facility;
- location of the main site access;
- operational water management storage;
- water supply; and
- pipeline corridor alignment options.

The alternatives considered for each of these aspects are discussed in the following sections.

6.2 Mine project area boundary

The project area associated with the mine development was first defined on the basis of anticipated land required to accommodate mining and processing operations, including the required waste rock emplacement and tailings disposal. Regis accordingly purchased land or negotiated an option to purchase land with the relevant landholders to accommodate the conceptual mine development layout as presented in the preliminary environmental assessment (PEA).

Throughout the project design and environmental assessment phase, a number of additional properties were either purchased by Regis, or an agreement to purchase was negotiated with the respective landholders. The project area was subsequently expanded to incorporate these additional properties. The mine project area presented in the PEA is illustrated in Figure 6.1, while the mine project area that is the subject of the development application for the project with additional areas highlighted is illustrated in Figure 6.2.

6.3 Mine lease application area and site layout

As described in Chapter 3, the project involves a mining development within the meaning of Part 4A of the Mining SEPP, and therefore the development application for the project must be accompanied by either a “Gateway Certificate”, where the development occurs on land which meets the definition of BSAL; or a “Site Verification Certificate” (SVC) that certifies that the land on which the proposed development is to be carried out is not BSAL.

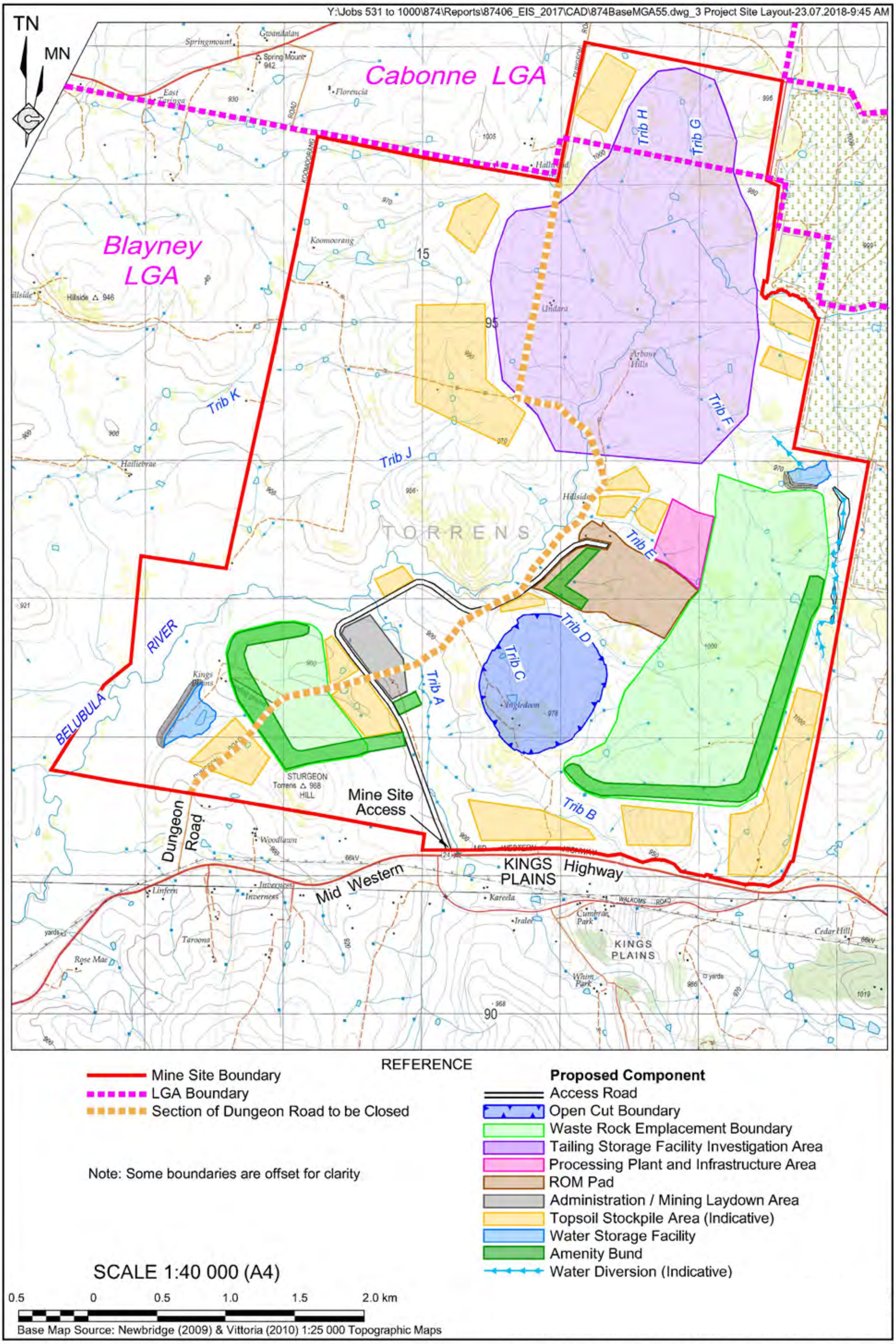
Detailed soil and related resource studies were completed for the project in accordance with the NSW Government’s (2013) *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land,* which identified potential BSAL within the western portion of the mine project area as defined in the PEA, and the proposed ML application area (which was the same as the mine project area). Therefore, to avoid any direct impacts to potential BSAL, the footprint of the mine development and the associated area to be the subject of a ML application was subsequently refined. As a result, there is no BSAL within the ML application area for the proposed development and an SVC was accordingly issued by the DPIE on 18 June 2019. The ML application area is shown in Figure 1.3.

6.4 Site layout

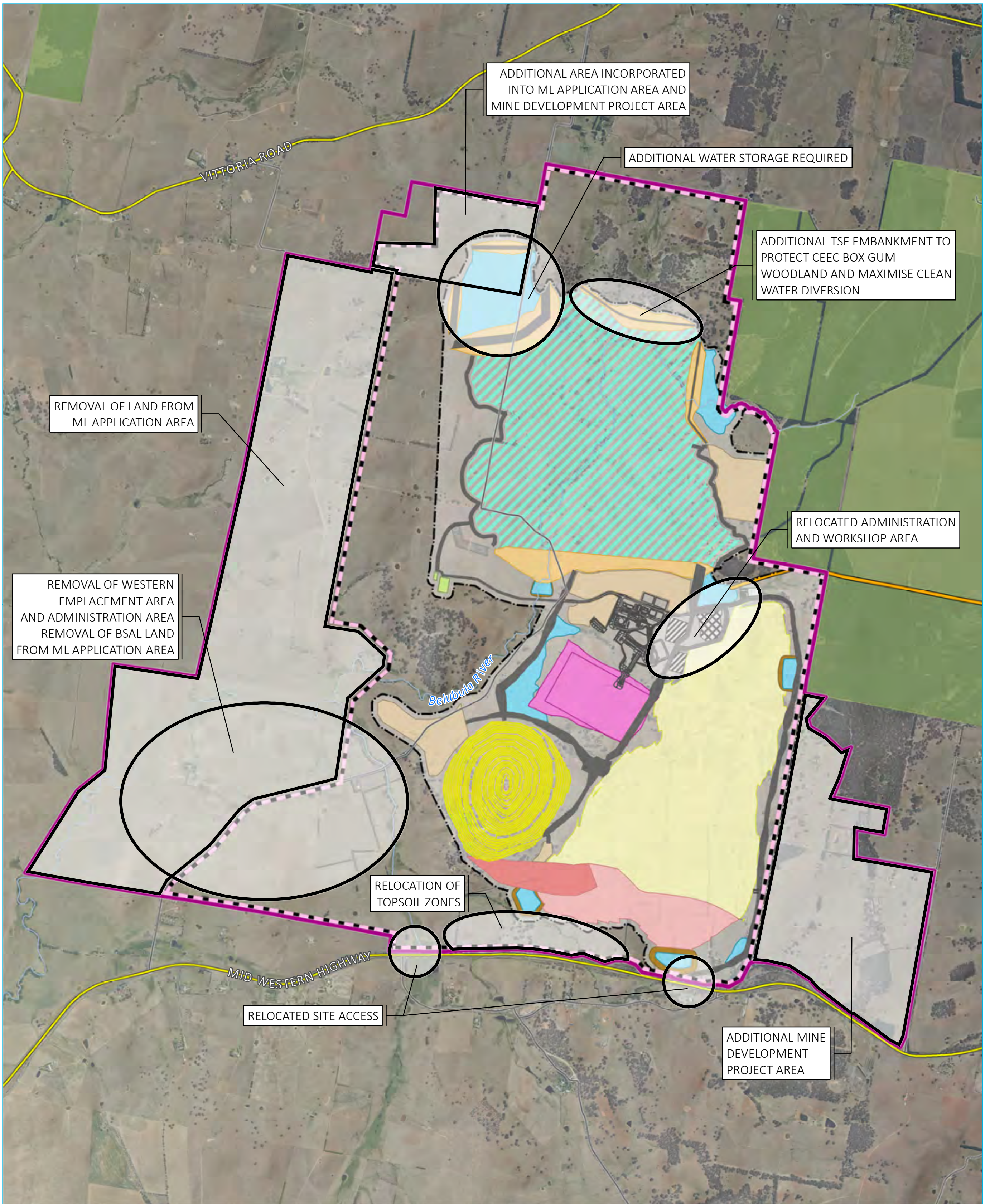
The mine development general arrangement has evolved considerably from the conceptual site layout presented in the PEA. This has been in response to the findings of technical assessments and mine design optimisation. Key changes to the mine development general arrangement are illustrated in Figure 6.2 and summarised as follows:

- the main administration area, mine support services and equipment laydown area was shifted to the eastern side of the project area, north of the main waste rock emplacement and in the vicinity of the processing plant and workshop;
- the western waste emplacement/amenity bund was removed altogether from the project;
- relocation of topsoil zones;
- relocation of the main site access point off the Mid Western Highway;
- addition of a northern TSF embankment to minimise impacts on the EPBC Act listed Critically Endangered Ecological Community White Box Yellow Box Blakely’s Red Gum Woodland and Derived Native Grasslands (CEEC Box Gum Woodland) and to maximise clean water diversion;
- inclusion of additional water storage (Secondary WMF) to ensure the mine development operates as a nil discharge site; and
- removal of land from the ML application area as described in Section 6.3 above.

The removal of the western waste rock emplacement area from the design greatly reduced noise and visual amenity impacts on sensitive receptors residing in the western area of the Kings Plains locality, particularly three rural dwellings located to the north-east of the Mid Western Highway and Dungeon Road intersection (R48, R47 and R43).



Ref: RW Corkery & CO PTY Limited (2018)



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

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KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Main road
- Local road
- Perennial watercourse
- Vittoria State Forest

Project general arrangement

- Open cut mine
- Plant layout
- Road
- Mine administration
- Southern amenity bund
- Pit amenity bund
- ROM
- Topsoil zone
- Water management facility (WMF)
- Sediment basin structure
- Waste rock emplacement
- Tailings storage facility

Evolution of mine development general arrangement

McPhillamys Gold Project
Environmental impact statement
Figure 6.2

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EMM creating opportunities

Similarly, relocation of the mine support services (such as the mine administration buildings, workshops, warehousing, employee and visitor carparking) and equipment laydown areas to the north of the open cut and in the vicinity of the processing plant and ROM pad, increased the separation of these activities from private residences which are generally to the south of the mine project area, thereby reducing the predicted amenity impacts on these receptors. The removal of mining activities from this portion of the mine project area also avoids impacts to the potential BSAL areas identified during the soil investigations for the mine development, as well as direct impacts on water resources in this portion of the mine project area.

Further detail regarding the TSF evolution and the additional operational water storage is provided in Sections 6.7 and 6.8 respectively, while Section 6.9 provides additional detail regarding the mine site access options considered.

6.5 Waste rock emplacement

6.5.1 Emplacement schedule

Preliminary noise modelling was undertaken to predict noise levels at surrounding residences associated with the initial mine design and waste rock emplacement schedule and the use of standard equipment. Early calculations identified that noise emissions had the potential to significantly exceed noise criteria for sensitive receptors residing in the Kings Plains locality.

As a result, several changes to the project design and the incorporation of mitigation measures were considered to achieve a feasible and effective noise reduction from the mine development. Analysis of initial noise predictions showed that the significant contributors to noise levels in Kings Plains were the construction of the waste rock emplacement and the movement of haul trucks, particularly as they exit the open cut pit. Subsequently, significant work was undertaken to redesign the construction of the waste rock emplacement to minimise noise levels on the residents in Kings Plains. The initial design that was considered involved constructing the northern end of the emplacement first and dumping waste rock progressively south. Whilst this was an efficient way to construct the emplacement particularly in terms of haulage distances, the lack of shielding of equipment in this design meant noise emissions would easily propagate south towards Kings Plains.

The emplacement schedule was then re-configured so that dumping of waste rock would commence in the south, building the southern face of the bund (ie the ‘southern amenity bund’, as shown in Figure 2.1) first and as quickly as possible so that this could act as a bund behind which equipment could work as the dump progresses north throughout the rest of the mine life. A second amenity bund was then added to the design immediately south of the pit exit point to shield the noise from trucks exiting the pit (the ‘pit amenity bund’, as shown in Figure 2.1).

The construction of these two amenity bunds in the initial stages of the mine development resulted in significant improvements to the predicted noise levels at the nearest sensitive receivers, particularly after the bunds were constructed (from about Year 3 onwards). The bunds also serve the dual purpose of providing an effective visual barrier, as discussed in Chapter 19.

6.5.2 Equipment noise suppression

Optimisation of the waste rock emplacement schedule, as described above, improved noise levels significantly, however exceedances still occurred in the early years of the emplacement schedule. As a result of this, noise modelling was undertaken with noise suppression equipment installed on key mining equipment (trucks, excavators and drills). The use of noise suppression equipment reduced noise levels at a number of receivers. A further contingency measure was developed in the form of emplacement of rock further to the north during the night time period under certain climatic conditions.

6.6 Gold extraction method

Cyanide is the most widely used reagent for recovering gold (particularly for low grade, gold only deposits such as McPhillamys). Cyanide has been successfully and safely used in Australia to recover gold for more than 40 years, including at two major gold mining projects currently operating in NSW.

Notwithstanding the above, Regis' process engineers and metallurgists carried out an assessment of alternative options to the use of cyanide to demonstrate cyanide is the only feasible gold extraction method for the project. This assessment is contained in Appendix CC. Alternative lixiviants such as chlorine and thiosulphate were assessed, along with metallurgical test work to review flotation process options, which can be applied for certain ores to produce a sulphide or copper concentrate. These alternatives are discussed further below.

6.6.1 Flotation

Flotation is an alternative processing method that does not always use cyanide. The flotation method produces a flotation concentrate that can then be transported from site by pipeline, trucks and /or rail to a port and then sold directly to a smelter (normally overseas). The ability to produce a flotation concentrate is dependent on the mineralogy of the ore. Typically, a gold deposit with low copper grades (such as the McPhillamys deposit) requires a minimum gold grade of around 40 g/t Au in the flotation concentrate to make it economically viable.

Both Newmont (previous McPhillamys EL holder) and Regis have carried out flotation test work on ore samples from the McPhillamys deposit. This test work showed the McPhillamys deposit, which has a gold grade of 1.04 g/t, would not produce a saleable concentrate using the flotation method.

6.6.2 Alternative reagents

Current alternative reagents (lixiviants) that have been utilised in small scale commercial processing of gold bearing ores include mercury, chlorine, thiosulphate and glycine. Mercury was not considered further due to safety and environmental issues associated with use. Alternative reagents such as thiosulphate have only been trialled on small scale applications with specific ore characteristics and as yet, have not been applied to or proven in processing large scale, low grade gold deposits.

6.7 Tailings storage facility

6.7.1 Tailing disposal options

An assessment of tailings disposal options was carried out based on sound engineering design practices and minimisation of environmental impacts. This assessment was then subject to a TSF risk assessment (Risk Mentor (2019b) on 8 March 2019 and this risk assessment was then peer reviewed alongside the TSF detailed design on 12 March 2019. The Regis project team, tailings dam designers (ATC Williams, CMW Geoscience), processing engineers, metallurgists and groundwater, surface water, and geochemical technical specialists (among others) participated in the TSF risk assessment (and peer review). The risk assessment of the tailings disposal options included but was not limited to the following:

1. Tailings disposal method options considered; and
2. Cyanide detoxification options.

i Tailings disposal method options

The tailings disposal options considered included:

- slurry disposal;
- paste disposal;
- filtered tailing (cake); and
- co-mixing (crushed waste with filtered tailings).

Each of these tailings disposal options were then risk assessed/mapped against relevant parameters related to their potential suitability including:

- water use;
- liner/seepage complexity;
- cyanide breakdown rate;
- acid mine drainage (AMD) risk (if PAF tailings);
- tailings stability;
- energy use;
- tailings footprint;
- location suitability;
- capital cost; and
- operating cost.

A qualitative review of the above parameters for the different disposal options is provided in Table 6.1. A colour coding system has been employed to define the impact of each variable. Green indicates the best result, black moderate and orange the worst result.

Table 6.1 Qualitative advantages and disadvantages of tailings disposal options

Variables	Slurry disposal	Paste disposal	Filtered tailings (cake)	Co-mixing (crushed waste with filtered tailings)
Water Use	Med	Low	Low	Low
Liner/Seepage Complexity	Med	Med	Low	High
Cyanide Breakdown Rate	High	Low	High	High
AMD Risk (if PAF Tailings)	Med	Med	Med	Med
Tailings Stability	High	High	High	Med
Energy Use	Low	High	High	High
Tailings Footprint	Low	High	Med	High

Table 6.1 Qualitative advantages and disadvantages of tailings disposal options

Variables	Slurry disposal	Paste disposal	Filtered tailings (cake)	Co-mixing (crushed waste with filtered tailings)
Location Suitability	High	Low	High	Med
Capital Cost	Med	High	High	High
Operating Cost	Low	Med	High	High

The results of the assessment indicated that the preferred approach for tailings disposal for the McPhillamys Gold Project is conventional slurry deposition methods.

ii Cyanide detoxification options

The cyanide detoxification options considered included alkaline chlorination, hydrogen peroxide, SO_2/air, ferrous sulphate, ozonation and Caro's acid.

Regis has selected the SO_2/air method as the optimal cyanide detoxification method for the project because of the following:

- the SO_2/air method is proven technology, especially for high tonnage/low grade gold deposits. It is utilised at the Cowal Gold Mine and Tomingley Gold Mine within NSW;
- lab scale test work has proven that this method is very efficient for the McPhillamys ore and will minimise the quantity of detoxification reagents required; and
- reagents are transported as solids, for safety and ease of transportation and storage.

6.7.2 TSF location options

The following TSF location options assessments were carried out to determine the optimised location for the TSF:

- options assessment by ATC Williams (2013). This initial assessment was concentrated within areas to the north and east of the open cut and was confined to the Belubula River catchment.
- revised options assessment by ATC Williams 2018. This revised assessment included options identified during the original assessment as well as additional options in a more regional context. This assessment also considered the opportunity to locate the TSF outside all significant drainage lines (defined as 3rd order stream and above).

The outcomes of the revised siting assessment identified four investigation areas considered potentially viable for the containment of the project's tailings. Within each of the main investigation areas, numerous TSF layouts were assessed, with a total of more than thirty different TSF options considered. The four investigation areas are described as follows:

- Area 1 – valley type storage containment with a primary embankment on the downslope end of the valley providing the containment;
- Area 2 - side-valley turkey's nest, with containment embankment extending on 3 to 4 sides of the TSF, generally located on the side slopes of a valley off the main drainage alignment of the valley;

- Area 3 - side-valley top of catchment, with containment embankments extending on three to four sides of the TSF, generally located on the upper slopes of a valley off the main drainage alignment of the valley; and

- Area 4 - valley type storage containment on a tributary of the Belubula to the south of the Mid Western Highway, with a primary embankment on the downslope end of the valley providing the containment.

A detailed assessment of the above options is provided in Section 3.3 of ATC Williams (2019) contained in Appendix D. The outcomes of the assessment determined Area 1, located within the Belubula River valley, was the preferred option due primarily to optimal geology with respect to groundwater permeability to protect the downstream Belubula catchment. This location was also considered the preferred location from a visual amenity perspective as the prevailing topography will shield views of the TSF from most offsite locations. In addition, the location accommodates an efficient TSF in terms of engineering design, in particular, embankment construction and tailings rate of rise.

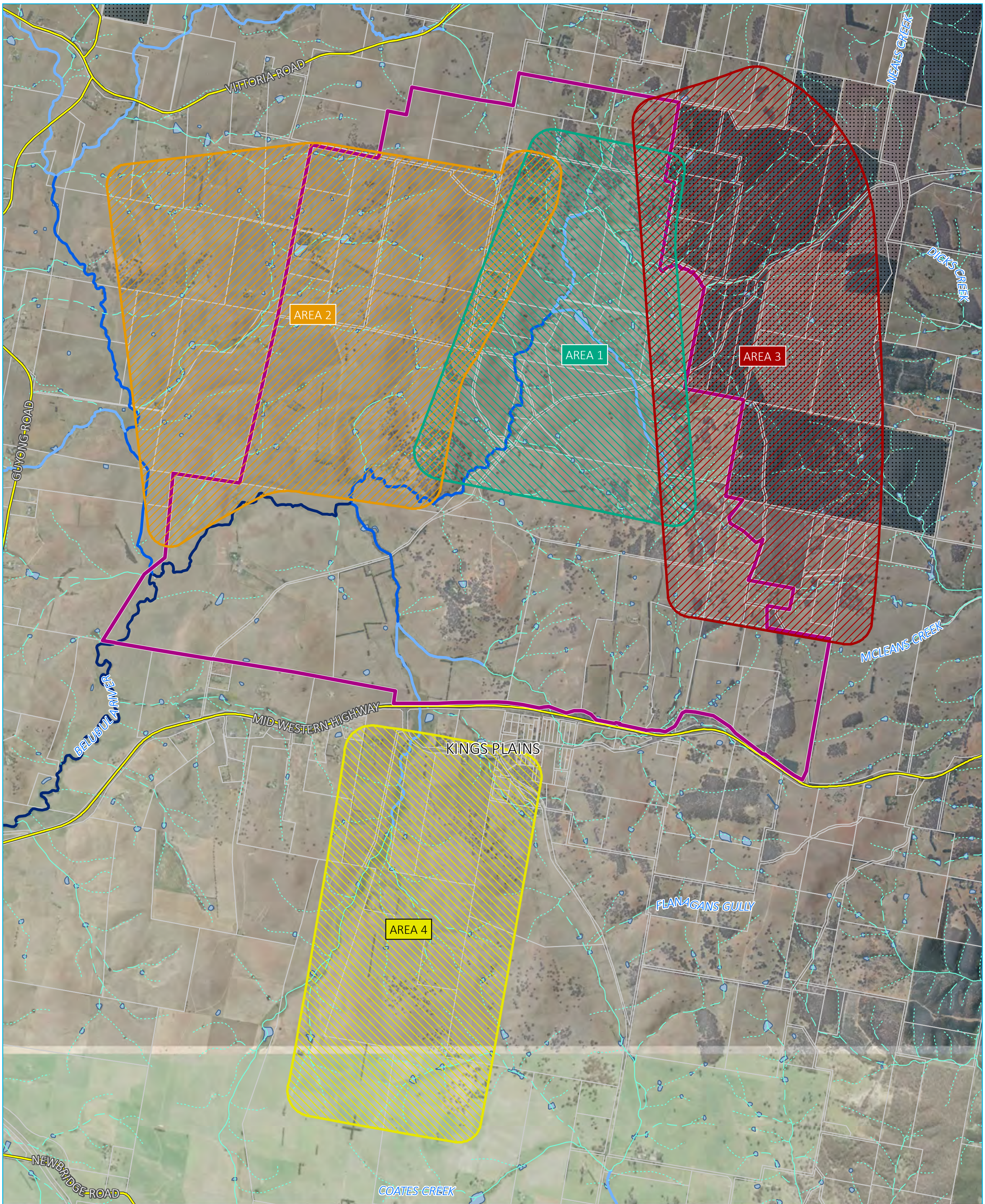
Within Area 1, a number of specific sites were assessed to refine the TSF location and layout design. These refinements focused on maximising diversion of clean water minimising earthworks, minimising impact to identified CEEC Box Woodland areas and constraining the TSF extents within Regis landholdings. Key designs considered are summarised below:

- Single embankment TSF design with no northern or eastern embankments (). While the most efficient in terms of embankment efficiency, this would have resulted in impacts including significant inundation of the CEEC Box Gum Woodland and impacts to adjacent Forestry Corporation of NSW land.

- Single embankment moved to the north to avoid Trib F and minimise the requirement for an eastern clean water diversion (Figure 6.5). Whilst reducing clean water diversion requirements, this variation significantly increased embankment volumes. It also significantly impacted on CEEC Box Gum Woodland in the north of the mine project area.

- Stepped valley style storage design (Figure 6.6). This design aimed to reduce the overall height of the southern embankment and promote clean water diversions. However, this design required significantly increased embankment volumes and did not sufficiently reduce the height of the southern storage and therefore no significant benefit for the eastern clean water diversion.

- Main TSF embankment design with confining embankments to the north and east. While this design requires significantly more embankment works (and therefore is more costly to build compared to single embankment options), it was the best design in terms of maximising clean water diversion and minimising impact on CEEC Box Gum Woodland. This design avoids approximately 5.1 ha of CEEC Box Gum Woodland compared to a design without the northern embankment. Accordingly, this design has been progressed.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPI (2015); ELVIS (2014)

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KEY

Project application area
Mine development project area (2,513.47 ha)

TSF location options
Area 1
Area 2
Area 3
Area 4

Existing environment
Main road
Waterbody
Cadastral boundary
Vittoria State Forest

Strahler stream order
1st order
2nd order
3rd order
4th order
5th order
6th order

TSF location options assessment

McPhillamys Gold Project
Environmental impact statement
Figure 6.3

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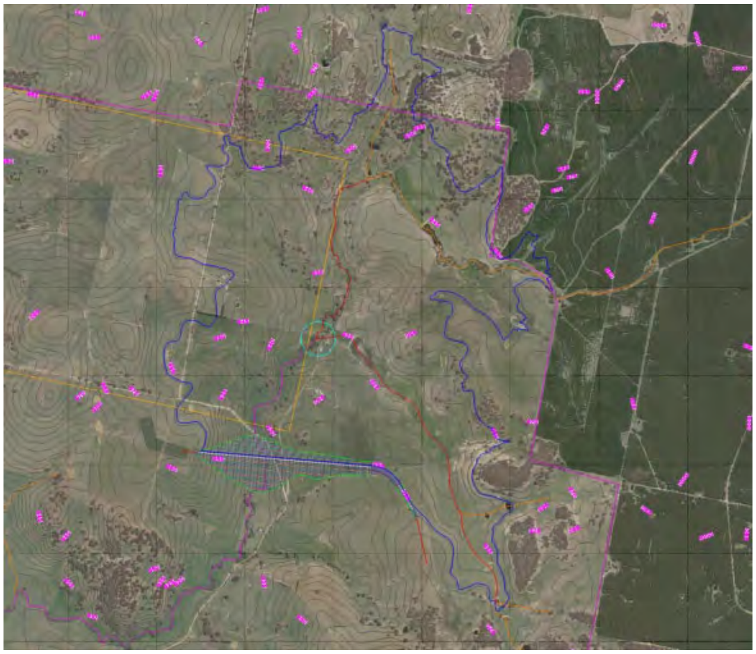


Figure 6.4 Single embankment TSF design

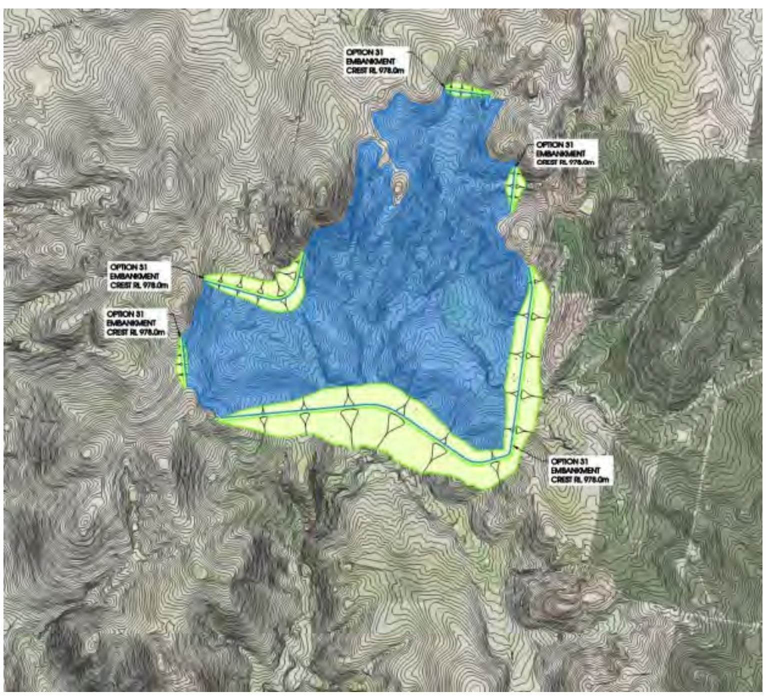


Figure 6.5 Single embankment northern option (avoiding Trib F)

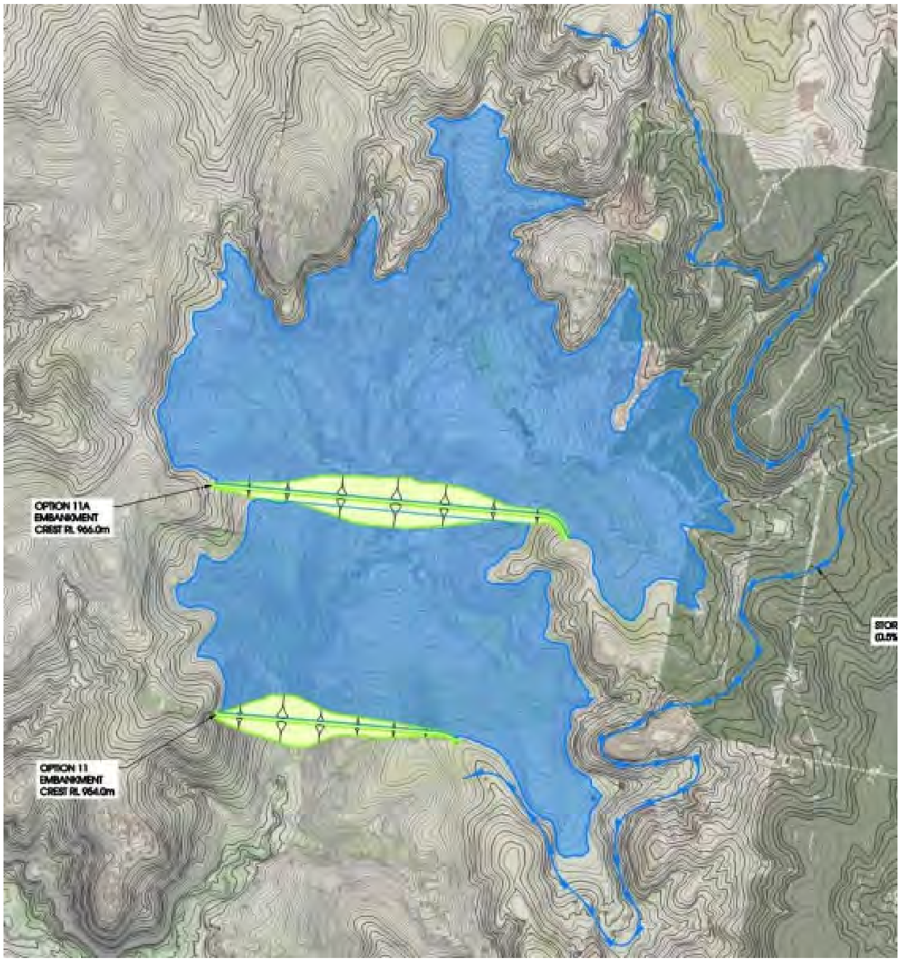


Figure 6.6 Stepped TSF design

6.8 Operational water management storage

The surface water investigations and surface water balance identified that additional water storage capacity was required to ensure the mine development is able to be operated as a nil discharge site. Options to site this necessary storage (known as the Secondary WMF) were constrained due to the removal of the BSAL affected areas of the mine project area from the ML application area as well as the prevailing topography of the remaining areas of the ML application area. In addition to this, there was a desire to avoid impacts on Trib A to the south of the open cut and minimise impacts on areas of CEEC Box Gum Woodland to the north of the TSF. Accordingly, Regis negotiated an agreement to purchase additional land to the north west of the PEA project area (refer Figure 6.2), to accommodate the Secondary WMF. Due to the prevailing topography, it has not been possible to shift this water storage to completely avoid native vegetation; however, all impact to CEEC Box Gum Woodlands has been avoided in the siting of this WMF.

Subsequent heritage investigations carried out on this new portion of the mine project area identified one site located in the footprint of the Secondary WMF, (MGP-H23 - the Hallwood Farm Complex), as being of local heritage significance (although not currently listed on local or state heritage registers). Landskape (2019) further considered that MGP-H23 as potentially holding some higher significance values; however, recommended that further assessment would be required to confirm heritage significance.

Options to avoid the site have been explored through the investigation of alternative locations for the Secondary WMF. However, due to the site constraints identified above, the current location has been confirmed as the most appropriate location when all environmental, social and economic factors are considered.

Further discussion on this heritage site is contained in Chapter 16. Further research will be conducted to confirm the significance of this site, and the mitigation and management measures for this site will then be updated accordingly as part of the preparation of the cultural heritage management plan.

6.9 Mine site access

Multiple options for the site access to the mine development were identified and assessed in terms of traffic impacts, impacts on the Kings Plains locality as well as road safety (ie minimum sight distance requirements) and constructability.

6.9.1 Existing shared property access option

Prior to the site access proposed in the PEA, the original proposal for access to the mine project area was to use an existing shared access off the Mid Western Highway located approximately 100 m to the west of the Walkom Road (east) intersection. This access currently provides access to two rural properties with dwellings owned by Regis. Access to these properties will not be required once the project commences and this location was therefore considered as a potential access option. As part of the investigations for this option, it was identified that minimum sight distance requirements could be achieved with the trimming and/or removal of roadside vegetation along the Mid Western Highway. However, it was subsequently determined that this option was not viable due to its proximity to turn lane configurations already in place along the Mid Western Highway at the Walkom Road (east) intersection and as a consequence, the existing property access was ruled out.

6.9.2 Alternative highway access options

Following the elimination of the existing shared property access option, a number of alternative locations off the Mid Western Highway were investigated. These included the site access proposed in the PEA which was located towards the western end of the mine project area near the Walkom Road (west) intersection (refer Figure 6.1). These locations were eventually ruled out due to constructability issues and conflicts with the entrance to Walkom Road (west) and the proposed internal layout of the mine project area.

6.9.3 Dungeon Road option

The existing access to the mine project area is via Dungeon Road. The configuration of the Mid Western Highway and Dungeon Road intersection consists of a basic left turn lane and a short channelised right turn lane and is considered to be generally suitable for project related traffic; however, if Dungeon Road was to become the only mine project area access point, the road would require significant upgrades. Existing deficiencies on Dungeon Road that would require resolution include:

- narrow culverts;
- substandard curves with no warning signs;
- trees and fence posts located within the clear zone; and
- bitumen seal and pavement in poor condition in areas.

There are two rural properties with dwellings located along Dungeon Road at the southern end and there would be unfavourable noise and dust impacts to these properties if Dungeon Road were used as the main project area access during operations.

6.9.4 Preferred site access

The proposed new site access and intersection are located on the Mid Western Highway approximately 190 m west of the Walkom Road (east) intersection. This preferred option satisfies minimum sight distance requirements and has been designed with dimensional capacity to cater for the turning movements of a 25 m B-Double. The proposed new turn lanes can be constructed while maintaining the existing turn lanes for the Walkom Road (east) intersection as shown on the concept design (refer Figure 17.2 in Chapter 17).

6.10 Water supply

The project requires a reliable and sustainable water supply, primarily for the proposed processing plant and for dust suppression requirements. Initial hydrogeological investigations indicated that the likelihood of sourcing such a supply from local groundwater was low. For this reason, an assessment of available water supply options was undertaken (EMM 2017) with options assessed up to a radius of approximately 100 km from the mine project area.

From this assessment, various options were identified that provided potentially viable solutions and warranted further investigation. Four of these were:

- recycled waste water from Bathurst wastewater treatment plant (WWTP);
- groundwater from one or more of the Lachlan alluvium zones;
- a hybrid solution sourcing water from local groundwater, surface water and the Belubula River downstream of Carcoar Dam; and
- surplus mine water from Centennial Coal operations in the Springvale area (the pipeline development).

6.10.1 Bathurst Regional Council recycled water

Regis approached Bathurst Regional Council with a proposal to purchase approximately 3.3 GL/year of recycled water from the Bathurst WWTP, which was at the time returned to the Macquarie River downstream of Bathurst. The proposal involved the construction and operation of a buried pipeline to the project area.

Regis commissioned an environmental impact assessment which was carried out under the supervision of Bathurst Council and then peer reviewed by recognised expert consultants, who confirmed that the removal of the waste water stream from the Macquarie River would not have significant adverse impacts, on the proviso that ‘cease to transfer’ rules were applied when flows in the Macquarie River were less than a specified threshold limit.

The key advantages of the Bathurst WWTP option were the beneficial reuse of wastewater, financial benefit to council from the sale of a waste stream and the protection of downstream water users via the application of ‘cease to transfer’ rules.

Despite the above recommendation, Bathurst Council recognised that the proposal had both community support and community opposition. As such, Council decided to defer any decision on the proposal until a development application was completed by Regis for McPhillamys.

Regis was unable to progress their development application without a reliable and sustainable water supply option and so the Bathurst WWTP recycling option was not progressed further.

6.10.2 Upper Lachlan Alluvium Zone 2

An assessment was undertaken of all available groundwater sources within an approximate 100 km radius of the mine development. The Upper Lachlan Alluvium Groundwater Source Zone 2 was identified as a potentially favourable water source due to availability of water and reliability of supply. In order to physically extract water from this source, a borefield would be required.

A desktop study of bore yields and borefield area requirements was undertaken to ensure that if a borefield did need to be established, that it could be done so in a manner that would have minimal impact on existing groundwater users.

Regis has since secured approximately 4.5 GL/annum of groundwater licences as a contingency in the event that the preferred western coalfield water supply option is unsuccessful.

6.10.3 Hybrid supply from local groundwater and surface water

The water supply option assessment also considered a hybrid solution comprising several sources of water, namely local groundwater and surface water and licences from the Belubula River downstream of Carcoar Dam. Although this option could provide a feasible water supply, it has not been investigated further since the preferred western coal fields water supply (the pipeline development) as well as the Lachlan groundwater alluvium water supply options were deemed viable options which would result in significantly less impacts to the surface and groundwater users.

6.10.4 Water transfer pipeline from the western coalfields (the pipeline development)

Regis approached Centennial and EA with a proposal to transfer surplus mine water from the western coalfields to the mine development. This option also involved Regis' construction and operation of a buried pipeline.

This water supply option would source water from three main areas: Centennial's Angus Place and SCSO, and EA's MPPS. This option is Regis' preferred source of project water. A Reverse Osmosis (RO) plant is currently being commissioned for the Springvale Water Treatment Project at MPPS.

Key advantages of the pipeline development (as described in Section 2.14) include the beneficial reuse of a reliable and sustainable water supply.

6.10.5 Pipeline development corridor alignment options

Three main options were considered for the pipeline corridor route as shown in Figure 6.7.

6.10.6 Option 1 – Transgrid and APA easements route

The pipeline corridor was originally proposed along the existing services easements using Transgrid easements from MPPS to Yetholme and the APA natural gas pipeline easement from about 1 km to the south-west of Yetholme, on the southern side of Great Western Highway to about 4.3 km north-west of Georges Plains.

There were a number of difficulties with this route, primarily that Transgrid required all works to be outside their easement which would have required the removal of many trees. In addition, the route involved over 90 individual landholders with whom negotiations and agreements would be required.

6.10.7 Option 2 – Purple copper butterfly route

As part of reviewing an alternative option route to the option 1 easement route, Regis considered a route which had the potential to improve the hydraulic gradient and potentially reduce the pumping required to transport the water to the highest elevation near Yetholme. A route was considered running south from Kirkconnell Road along Macabees Road, then west along Yetholme Drive to Sibleys Road. This is shown as option 2 in Figure 6.7.

Biodiversity surveys were conducted along this route because of the potential to impact the vulnerable purple copper butterfly, by disturbing the host plant Blackthorn (*Bursaria spinosa* sub-species *lasiophylla*), which is used by the butterfly as a larval food. The surveys indicated the presence of Blackthorn adjacent to the pipeline route. As the purple copper wing butterfly is listed as a vulnerable species under the EPBC Act, disturbance of this habitat would likely constitute a significant impact on this species. Consequently, Regis considered the impacts on this species to be unacceptable and the option 2 route was discarded.

6.10.8 Option 3 – Forestry and roads route

Given the difficulties with option 1, an alternative option was devised following consultation with Lithgow and Bathurst Regional Councils and the Forestry Corporation of NSW who indicated that they were prepared to allow the easement along Council roads and forestry roads and adjacent land. This alternative route consolidated the number of potentially affected landholders to 19 plus 10 other stakeholders, including the Councils, Forestry Corporation of NSW, state government authorities (RMS, Department of Fishers, Crown Land, Railcorp), EA and Centennial. Option 3 subsequently was progressed as the preferred option.

6.10.9 Preferred option

The chosen pipeline route (option 3) maximises the use of road reserves and existing cleared land, and minimises the need for excessive clearing and easement acquisition over private land.

The pipeline development applies the principles of avoiding, minimising and mitigating impact to biodiversity and threatened species and threatened ecological communities. This has influenced the choice of route for the pipeline corridor, the use of construction techniques such as underboring, implementation of environmental safeguards to manage unavoidable impacts, and offsetting impacts where required.

Regis has undertaken significant work as part of the concept design process to refine the route to minimise the potential environmental and community impacts. Preparation of the concept design for the project has been driven by a sustainable design philosophy, based on integrating the design with an understanding of the potential environmental impacts, and ‘designing out’ as many impacts as possible. Regis has placed a strong focus on:

- reducing the number of impacted landowners;
- complying with the preferences of landowners and avoiding landowners who did not want the pipeline on their properties;
- considering the feedback from Lithgow Council, Bathurst Regional Council, Blayney Council, the RMS and Forestry Corporation of NSW;
- avoiding the wetland area around the intersection with the Coxs River which changed the route from using the Coalpac privately owned Haul Road from Angus Place Colliery to following a route through farmland to a narrow crossing of the Coxs River about 550 m to the south;
- avoiding major services at:

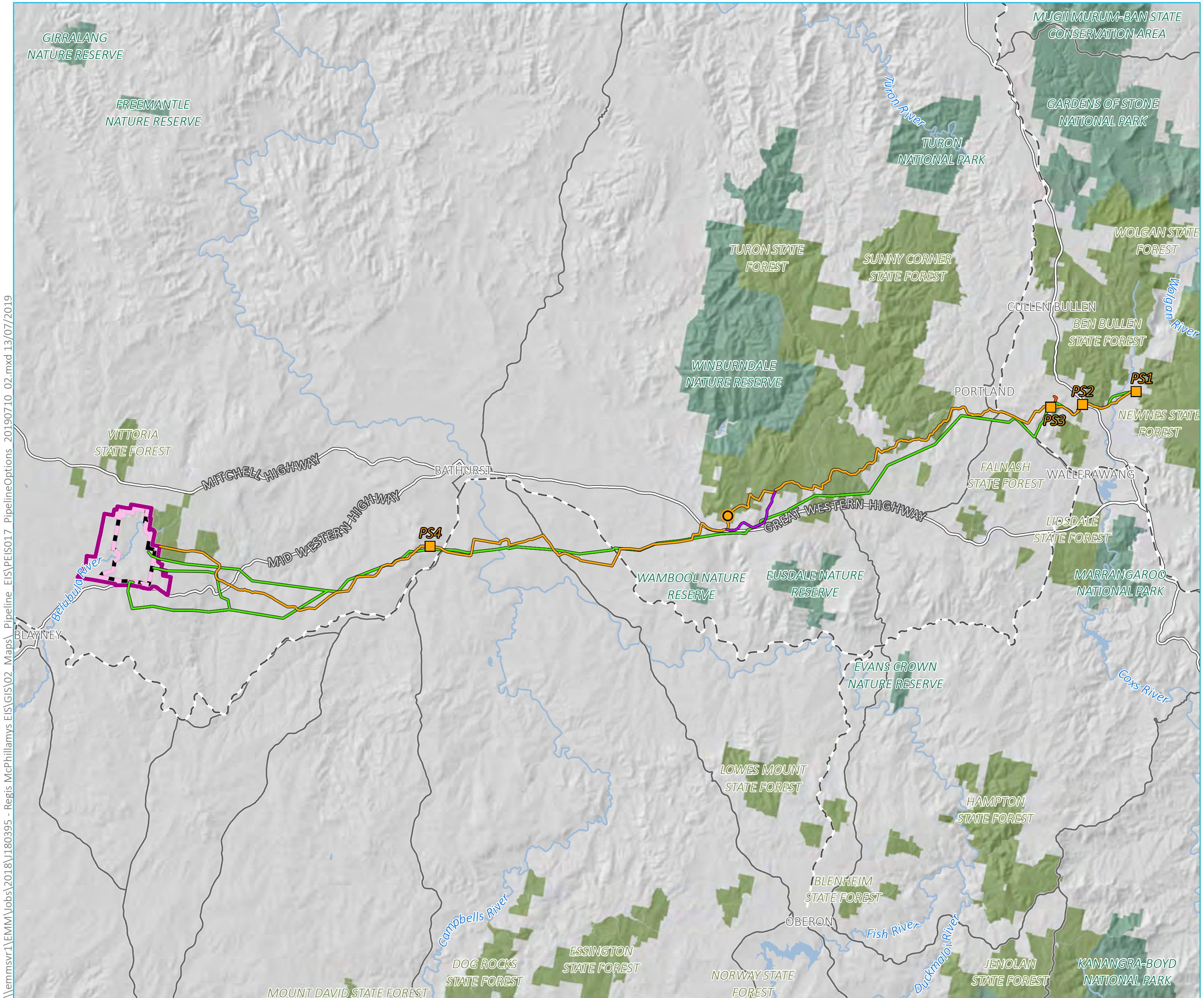
- Kirkconnell Road near the Kirkconnell Correctional Centre which has services along the road;
- the switching yard for MPPS which has high voltage power lines; and
- the APA gas pipeline easement other than for the pipeline crossings.

• avoiding heritage items by:
  - making adjustments to the route to avoid impacting the Portland General Cemetery which is heritage listed; and
  - placing the pipeline route on the western side of O'Connell Road to avoid any conflict with the heritage listed Leeholme Homestead.

• minimising impacts to biodiversity by:
  - route selection with the pipeline corridor traversing large extents of cleared agricultural land and timber plantations without any native vegetation present. Where possible, the pipeline will be trenched into existing roads and tracks, minimising impact to native vegetation and threatened species habitat;
  - refinement of the pipeline corridor within areas of native vegetation to minimise impact;
  - the pipeline corridor has been chosen to avoid recorded populations of host plants (*Bursaria spinosa*) of the Purple Copper Butterfly. Impact to essential breeding habitat for the species has thus been avoided;
  - the footprint for pumping station facility No.4 at Bathurst Bike Path has been reduced from 75 m x75 m to 50 m x 35 m to minimise impact on CEEC Box Gum Woodland;
  - impact to threatened fish distribution and key fish habitat in the Macquarie River and Queen Charlottes Creek will be avoided by underboring; and
  - an area of intact native vegetation adjacent to MPPS will be underbored to avoid impact on this vegetation.

• avoiding areas susceptible to erosion and carefully selecting preferred creek crossing sites; and

• avoiding farm infrastructure and dwellings.



KEY

- Pipeline corridor option 1
- Pipeline corridor option 2

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)
- Pumping station facility
- Pressure reducing system

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest

Source: EMM (2019); Regis Resources (2019); DPE (2018); DFSI (2017); GA (2011)

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Pipeline corridor route alignment options

McPhillamys Gold Project
Environmental impact statement
Figure 6.7

Part D

Impact assessment – mine development

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Chapter 7

Soil and land resources



7 Soil and land resources

7.1 Introduction

An assessment of the mine development's impacts on soil and land resources was prepared by Sustainable Soil Management (SSM 2019a). This included a baseline assessment across the mine project area involving a BSAL verification, a detailed soil survey, and a land and soil capability assessment. These assessments included a desktop review of existing land and soil data, a field assessment and laboratory analysis of collected soil samples. The BSAL assessment was undertaken in accordance with the requirements of the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (NSW Government 2013) (the interim protocol). The assessment verified the mine project area as non-BSAL and an SVC was subsequently issued for the project by the DPIE on 18 June 2019.

The Land Capability and Soil Assessment is presented in full in Appendix H, and a summary provided in this chapter. The specific EARs relating to soil and land resources are presented in Table 7.1.

Table 7.1 Land and soil resources related EARs for the mine development

Requirement	Where addressed
The EIS must address the following specific issues: **Land** - including an assessment of:	
the likely impacts of the development on the soils and land capability of the site and surrounds, and a description of the mitigation and management measures to prevent, control or minimise impacts of the development;	Section 7.3 (impact assessment) Section 7.4 (mitigation and management) Appendix H
the likely agricultural impacts of the development, including identification of any strategic agricultural land;	There is no strategic agricultural land in the proposed mining lease application area. An SVC was issued for the project on 18 June 2019. The Agricultural Impact Statement is included in Appendix I and summarised in Chapter 8.
the likely impact of the development on landforms (ie local topography), including the long term geotechnical stability of any new landforms proposed on site; and	Chapter 22 and Appendix U (Rehabilitation and Landscape Management Strategy).
the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007, paying particular attention to the agricultural land use in the region.	A discussion on the requirements of the Mining SEPP is provided in Chapter 3. The compatibility of the development with surrounding land uses is also discussed in Chapter 39 (project justification), and further information on the impacts of the project with surrounding agricultural land uses is provided in Chapter 8.

Information and results from the soil and land assessment was used in the preparation of a separate AIS (Appendix I and summarised in Chapter 8), which meets the agricultural related requirements noted in the above EARs.

The land capability and soil assessment was conducted with reference to the following standards, methods and guidelines:

- *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSW Government 2013);
- *The land and soil capability assessment scheme: second approximation* (OEH 2012);

- *Guidelines for surveying soil and land resources* (McKenzie et al 2008);
- *Australian soil and land survey – Field Handbook* (NCST 2009);
- *The Australian soil classification* (Isbell 2016);
- *Selection of Topdressing Material for Rehabilitation of Disturbed Areas* (Elliot & Veness 1981); and
- NSW Government's *Acid Sulphate Soils Assessment Guidelines* (Ahern et al., 1998).

7.2 Existing environment

7.2.1 Geology

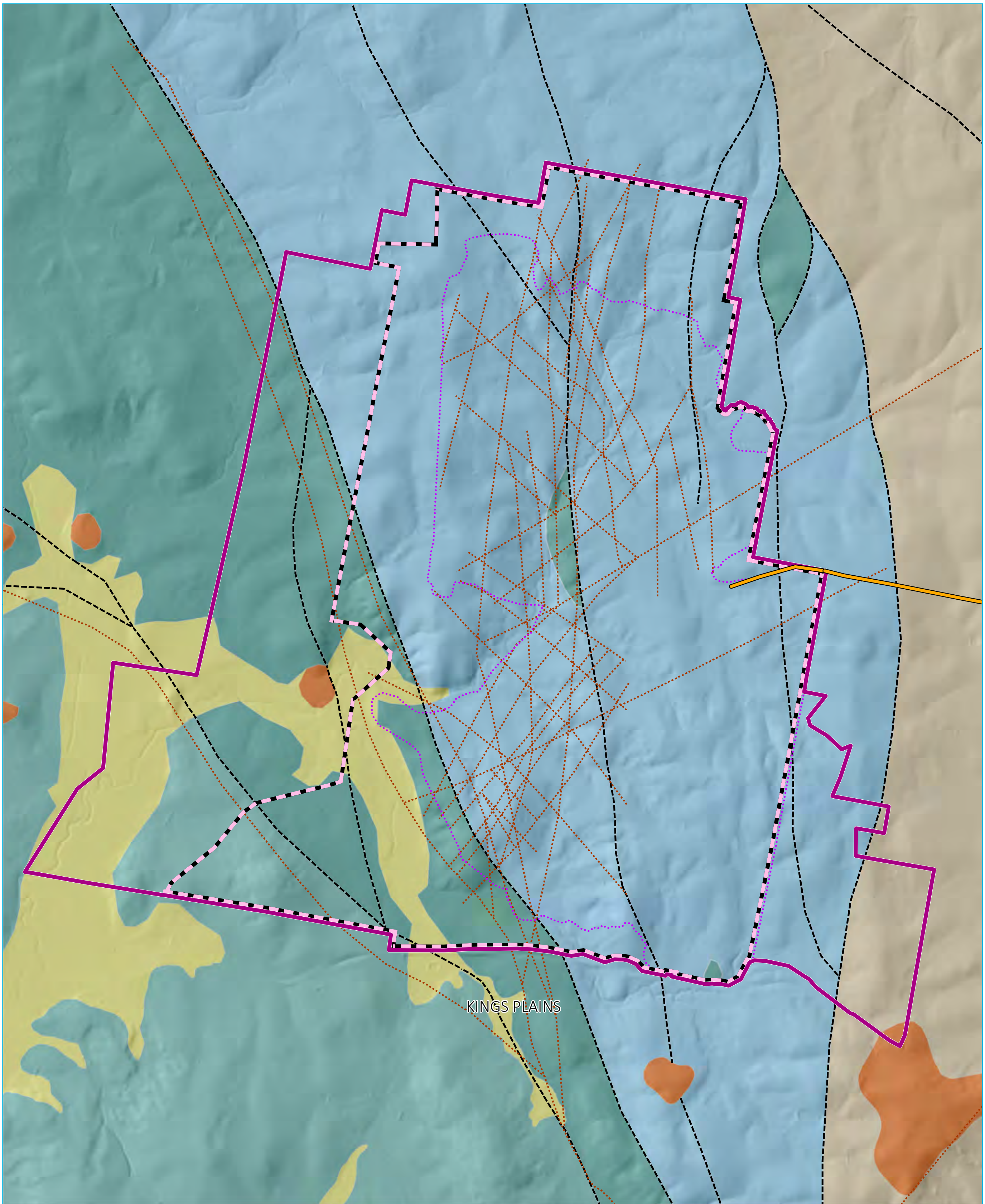
Geology beneath the mine project area becomes gradually older from east to west. The youngest material is the Devonian (359 to 419 million years ago, mya) Cunningham Formation. The majority of the mine project area is underlain by the Silurian (440 to 410 mya) Anson Formation, with older Ordovician (500 to 444 mya) Byng and Blayney Volcanics along the western side of the mine project area, as shown in Figure 7.1.

The Cunningham Formation is dominated by slates with thin sandstones and conglomerates. The Anson Formation typically contains siltstone, sandstone interbedded with feldspathic meta-sandstone and some limestone. The Byng Volcanics were deposited as flows of basalt and andesite. The Blayney Volcanics are classified as andesite and basalt. The Belubula River floodplain is mapped as Quaternary Alluvium.

Pogson and Watkins (1998) noted that the Cunningham Formation forms rugged and barren ridges which constitute very poor agricultural land. While the Anson Formation is dominated by siltstone, it contains layers of conglomerate, limestone and thin layers of volcaniclastic (made of small volcanic fragments) rock. Exploratory drilling for the McPhillamys Gold Project has found that bedding planes in the Anson Formation are close to vertical (T. Ridges, pers comm.). The Byng and Blayney Volcanics were laid down as flows of basalt and andesite (Pogson and Watkins, 1998), which was deposited in thicker layers than the Anson and Cunningham Formations.

The geology has two important effects on soil distribution across the mine project area. First, the near vertical bedding planes of sedimentary rock would result in larger short-range variation in soil developed on the Cunningham and Anson Formations. In contrast, it is likely that the Byng and Blayney Volcanics are likely to be more uniform as the lava flows are thicker and more uniform than layers of sedimentary rock. Second, it would be expected that soil developed from weathering of basic and intermediate volcanic rock of the Byng and Blayney Volcanics would be inherently more fertile than soil developed from metamorphosed sedimentary rock in the Cunningham and Anson Formations. This is consistent with the findings of the BSAL assessment (refer to Section 7.2.5) which found potential BSAL in the bottom south-west corner of the project area, coinciding with the Byng and Blayney Volcanics.

Geological units have also been categorised across NSW according to their potential to contain naturally occurring asbestos. The Anson Formation, over which the disturbance footprint associated with the mine development lies, has been categorised as having low asbestos potential. The extensive exploration drilling program conducted to date on site has not identified any naturally occurring asbestos to date in cores drilled. Notwithstanding, Regis will follow appropriate procedures for naturally occurring asbestos as recommended by SafeWork NSW and in accordance with Regis' naturally occurring asbestos procedure.



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Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

KEY

Interpreted structure

Geology (Bathurst 250k, 2nd Edition)

Fault

Quaternary / Tertiary

Alluvium

Tertiary basalt

Devonian

Ungrouped Devonian Formations - Cunningham Formation

Silurian

Mumbil Group (Northwest) - Anson Formation

Ordovician

Cabonne Group - Blayney Volcanics

Cabonne Group - Byng Volcanics

Project application area

Mine development project area (2,513.47 ha)

Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Disturbance footprint

Pipeline corridor

Geology of the project area

McPhillamys Gold Project
Environmental impact statement
Figure 7.1

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7.2.2 Soil landscapes

The project area was mapped by Kovac *et al*., (1989) as belonging to two soil landscapes. The elevated and undulating parts of the project area were mapped as Vittoria-Blayney Soil Landscape (refer to Figure 7.2). Soil profiles in the Vittoria-Blayney soil landscape have a consistent pattern of loamy topsoil over clayey subsoil that is red in elevated parts of the landscape and tends to be mottled yellowish brown in lower parts of the landscape. Kovac *et al*., (1990) rated land capability of all profiles they reported in the Vittoria-Blayney Soil Landscape as Class 3, 4 or 6; rated three of the four soil types as low chemical fertility and rated the soil with yellow subsoil as imperfectly to poorly drained.

Areas in the floodplain of the Belubula River were mapped by Kovac *et al*., (1989) as Macquarie Soil Landscape. Although soil types in the Macquarie Soil Landscape are also variable, all four soil types described in this landscape were allocated to LSC Class I, 2 and 3 (Kovac *et al*., 1990).

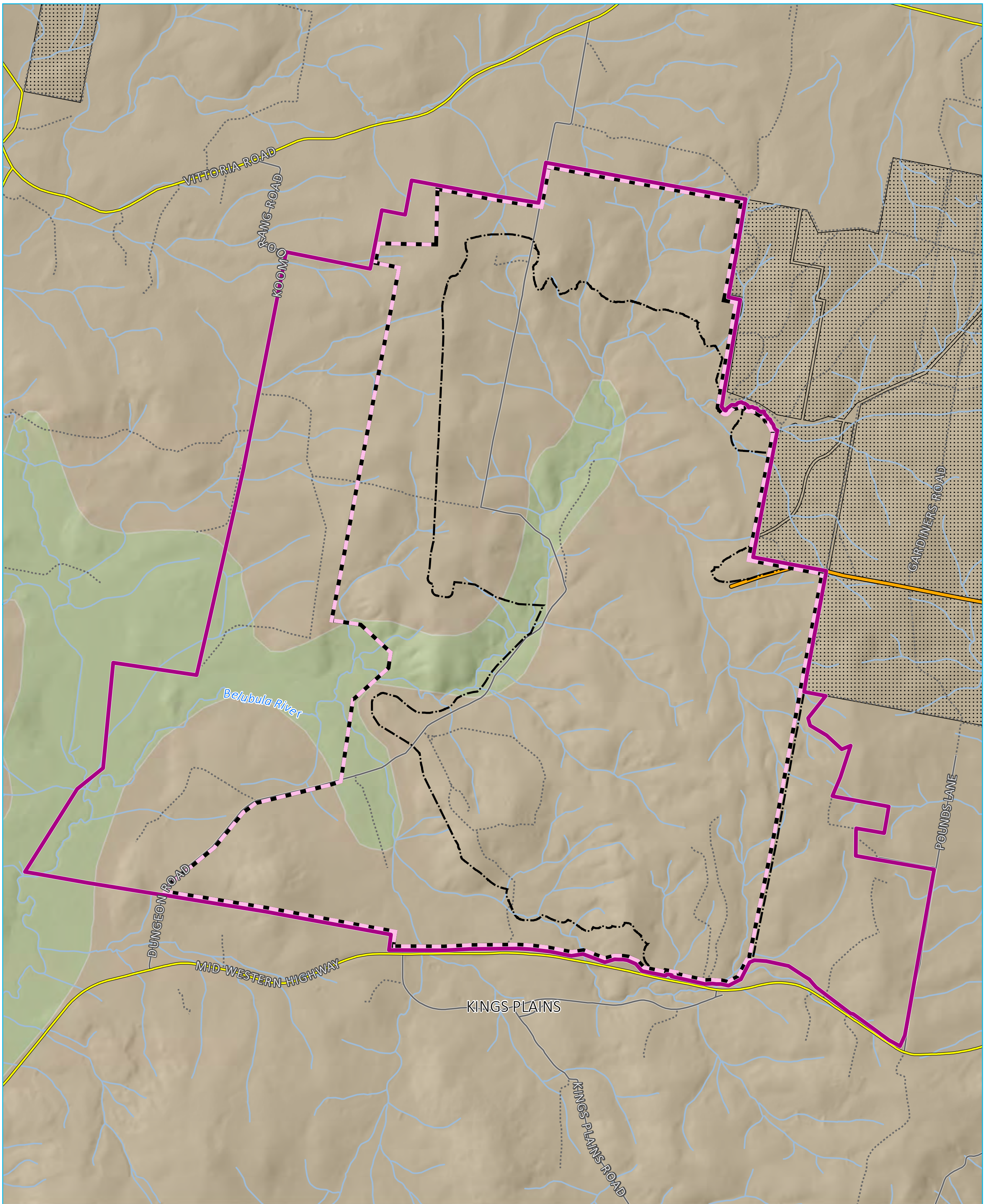
7.2.3 Soil types

A field survey was undertaken in accordance with the standards and guidelines listed in Section 7.1 to identify the specific soil types in the project area. A total of 131 sites were assessed across the 2,513 ha project area, which represents an average inspection density of one site per 19 ha. Soil properties were described in soil pits that were dug to 1.4 m or refusal by a 5 tonne mini-excavator. The location of each pit was recorded using a hand-held GPS.

Laboratory testing was undertaken to assist in the classification of soil types and the determination of land and soil capability classes. Soil samples were collected from standard depths of 0 to 5, 5 to 15, 15 to 30, 30 to 60 and 60 to 100 cm for all detailed sites unless the depth range covered the boundary between the A and B horizons of duplex profiles.

Samples from 127 of the 131 sites were subjected to laboratory analysis. Results from five cores sampled in the project area were also incorporated into the data set used for the survey. A summary of the Soil Associations identified in the project area is provided in Table 7.2 and illustrated in Figure 7.3.

There are no acid sulfate soils in the project area, as per the *Guidelines for the Use of Acid Sulfate Soil Risk Maps* (DLWC 2000). The NSW OEH Acids Sulphate Risk Map (OEH 2018) indicates that the nearest site with a high probability of occurrence of acid sulfate soil is further than 100 km from the project area and has 900 m lower elevation.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DECC (2012); ELVIS (2014)

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KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Soil landscape
- mq - Macquarie
- vb - Vittoria-Blayney

Soil landscapes of the project area

McPhillamys Gold Project
Environmental impact statement
Figure 7.2

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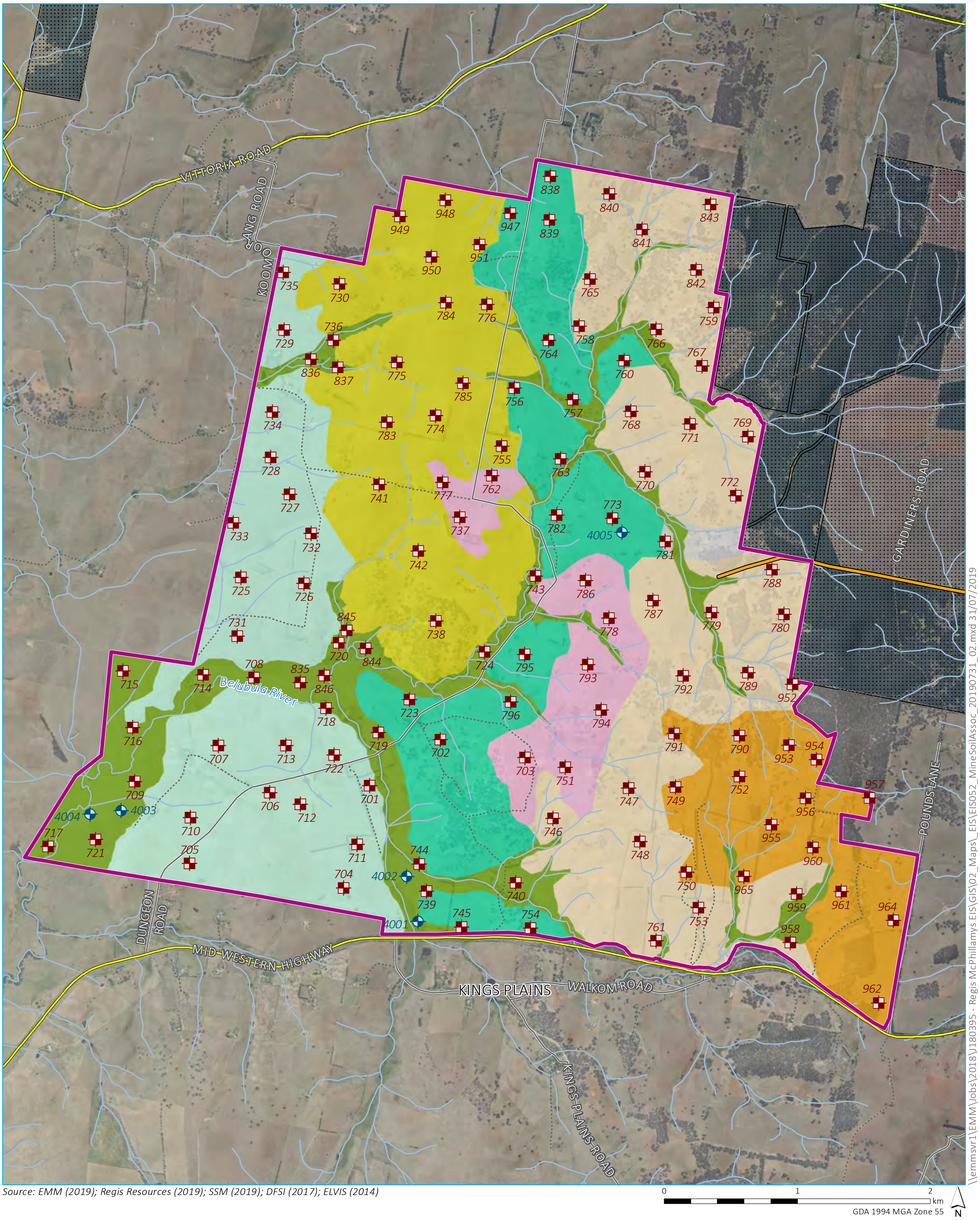
Table 7.2 Summary of soil associations in the mine project area

Soil Association	Description	Soil Types within the Soil Association	Project Area (ha)	Project Area (%)
Alluvium	Soils located in the depositional parts of the landscape.	Black Dermosols, Black and Grey poorly drained soils, Brown Alluvium	313	12.5
Manganic East	Non-alluvium soil which had impeded drainage indicated by 17 of 18 profiles with having a manganic layer in the B horizon, and was generally located on midslopes on Anson Formation parent material	Brown and Grey Chromosols, Dermosols, Kandosols and Sodosols	358	14.2
Manganic West	Non-alluvium soil which had profiles that had a manganic B horizon	Brown, Grey, Yellow and Red Dermosols, Chromosols and Sodosols	463	18.4
Red Soil	Non-alluvium soil which had red subsoil, and was also strongly acidic, well structured and well drained	Red Chromosols and Red Dermosols	145	5.8
Upland Centre	Non-alluvium soil which was in more elevated land than the Manganic East association, and was west of the Belubula River	Brown , yellow grey and Red Dermosols, Chromosols and Kandosols	435	17.3
Upland East	Non-alluvium soil which was east of the Belubula River and was strongly leached, indicated by strongly acidic profiles	Brown and Yellow Dermosols, Chromosols, Kurosols, Sodosols and Kandosols	567	22.6
Upland East-Aluminic	Non-alluvium soil Association was near the boundary of the Anson and Cunningham Formations, and had subsoil that was more acidic, and had elevated proportions of exchangeable aluminium and magnesium	Brown and Red Dermosols, Chromosols, Kurosols and Kandosols	220	8.8
Sodic Discharge	Non-alluvium soil which was represented by one pit, near an area of scalded soil, and had chemistry that was so different to the 112 remaining sites that it was mapped separately		13	0.5
			2514*	100.0

**Difference in project area (2,513 ha) due to rounding*



Source: EMM (2019); Regis Resources (2019); SSM (2019); DFSI (2017); ELVIS (2014)

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Pipeline corridor

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Soil site

- Core
- Detail pit

Soil association

- Alluvium
- Manganic East
- Manganic West
- Red Soil
- Sodic Discharge
- Upland Centre
- Upland East
- Upland East-Aluminic

Soil associations in the project area

McPhillamys Gold Project
Environmental impact statement
Figure 7.3

7.2.4 Land and soil capability

The LSC classes of the project area were assessed in accordance with the requirements of the *Land and soil capability assessment scheme* (OEH 2012). This involved assessment using data sourced from desktop review, field survey observations and soil laboratory analysis.

The LSC assessment found that the project area is predominantly LSC classes 4 and 5, which is consistent with the historic land uses of growing naturalised pasture to support grazing by cattle and sheep. There is no class 1, 2 or 3 land in the project area.

Although much of the project area has been cultivated, use of the land for cropping was constrained in two general patterns. Elevated land in the Red Soil, Manganic West, Manganic East, Upland Centre and Upland East associations is constrained by acidic pH and associated elevated exchangeable aluminium percentage. This is associated with topsoil that had limited capacity to store nutrients indicated by low cation exchange capacity (CEC). The less acidic alluvium association is constrained by seasonal waterlogging in winter months (SSM 2019a).

The acidic nature of the soil constrains the range of crops that can be grown without amelioration with an agent such as lime. The low CEC indicates that nutrients would generally be applied as needed rather than being applied in large doses, then using the soil as a nutrient reservoir. The seasonal waterlogging would constrain access for agronomic operations such as topdressing and weed control as well as limiting yield in the areas most affected.

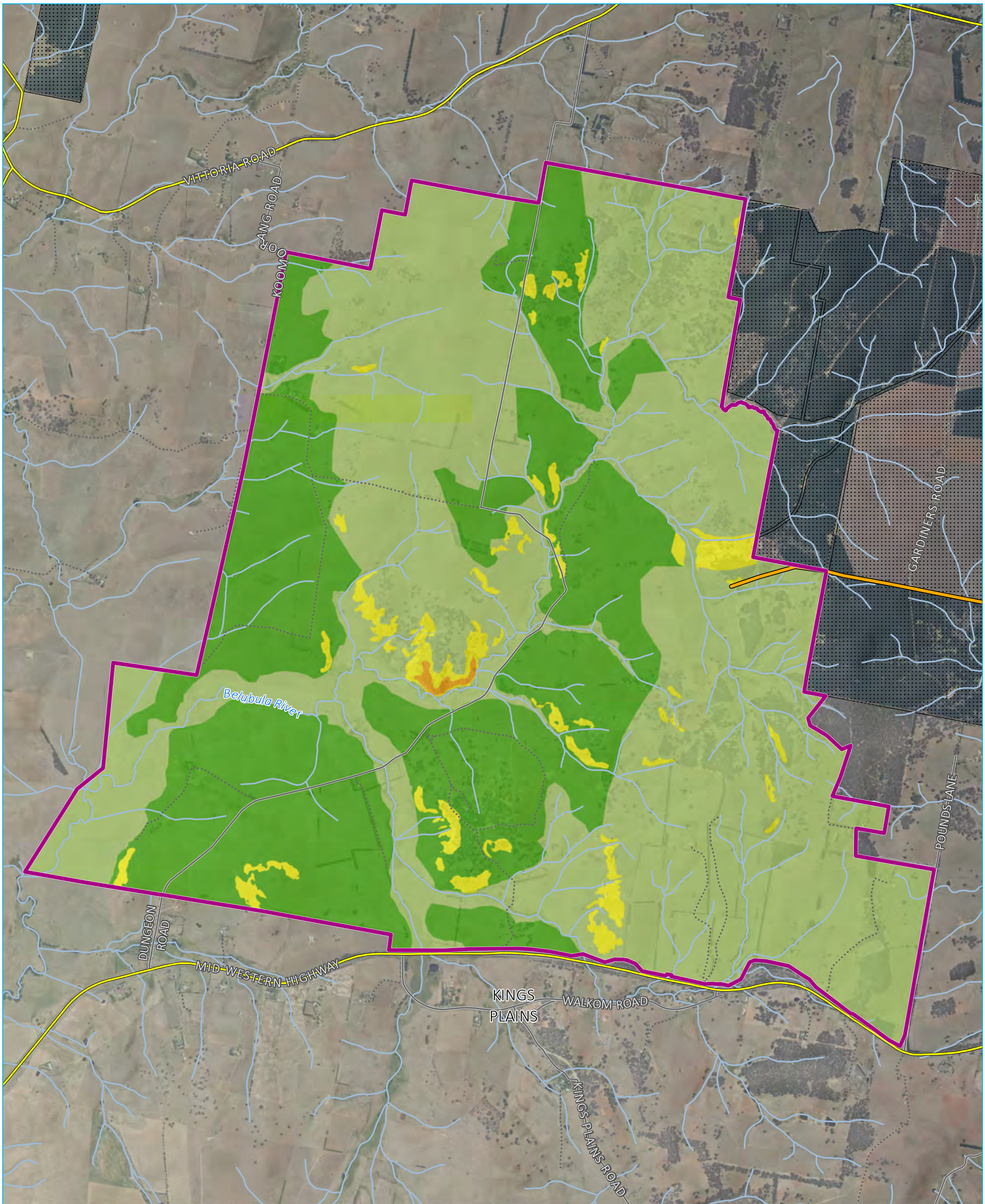
Table 7.3 summarises the LSC classes in the project area and Figure 7.4 shows the spatial distribution of LSC class across the project area.

Table 7.3 Summary of LSC assessment for the mine development

LSC class	Description	Area (ha)	%
Land capable of wide variety of uses (cropping, grazing, horticulture, forestry, nature conservation)			
1	Extremely high capability land: Land has no limitations. No special land management practices required. Land capable of all rural uses and land management practices.	0	0
2	Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.	0	0
3	High capability land: Land: has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental limitations.	0	0
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)			
4	Moderate land capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.	932	37.1
5	Moderate-low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations will need to be carefully managed to prevent long-term degradation.	1491	59.3

Table 7.3 Summary of LSC assessment for the mine development

LSC class	Description	Area (ha)	%
Land capable of wide variety of uses (cropping, grazing, horticulture, forestry, nature conservation)			
Land capable of a limited set of land uses (grazing, forestry, nature conservation and some horticulture)			
6	Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.	86	3.4
Land generally incapable of agriculture land use (selective forestry, nature conservation)			
7	Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.	4	0.2
8	Extremely low capability: Limitations are so severe that land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.	0	0.0
		2,513	100.0



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Source: EMM (2019); Regis Resources (2019); SSM (2019); DFSI (2017); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Pre-mining LSC class
- 4
- 5
- 6
- 7

Existing land and soil capability classes in the project area

McPhillamys Gold Project
Environmental impact statement
Figure 7.4

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7.2.5 Biophysical strategic agricultural land (BSAL)

As mentioned in Section 7.1, a site verification for BSAL was undertaken in accordance with *the Interim protocol for site verification of Biophysical Strategic Agricultural Land* (NSW Government, 2013), finding no BSAL within the proposed mining lease application area (SSM, 2019b). Subsequently a Site Verification Certificate was issued by the DPIE on 18th June 2019.

As can be seen in Figures 1.3 and 2.1, the proposed mining lease application area for the project, over which the SVC applies, differs from the project area. This is because the proposed disturbance footprint of the mine and mining lease application area were reduced to avoid any potential BSAL. The NSW regional trigger maps indicate the presence of BSAL within the project area in the lower reaches of the Belubula River and continuing outside of the project area to the west and south-west. The soil assessment found BSAL points within the western portion of the project area, and consequently the proposed mining lease application area was reduced to avoid potential impacts on this land.

7.3 Impact assessment

7.3.1 Overview

The potential impacts of the mine development on soil resources in the mine project area are associated with the temporary loss of land during construction and operation of mine infrastructure, permanent loss of land in the open cut void, and the permanent reduction in productive potential of the land used to store waste rock and some mine infrastructure areas. No impacts to soil and land resources are predicted outside of the proposed disturbance footprint (as defined in Figure 1.3). This assessment therefore focuses on the disturbance footprint within the project area.

Soil disturbance will be restricted to land owned by Regis, and predominantly in areas that have been cleared of trees and planted with introduced phalaris and sub-clover pasture. The thin veneer of topsoil in the project area means that any disruption of topsoil will expose a layer of less stable loamy soil. For this reason, topsoil will be removed from all soil that is disturbed to construct and operate the mine. Disturbance includes levelling required to form pads for construction of buildings, laydown yards, roads and the ROM pad as well as the more obvious disturbance of the waste rock emplacement and the TSF. Soil in the floor of water storages should not require topsoil to be removed and stockpiled.

All disturbed land except the void will be rehabilitated with stockpiled soil to return the land to a stable state.

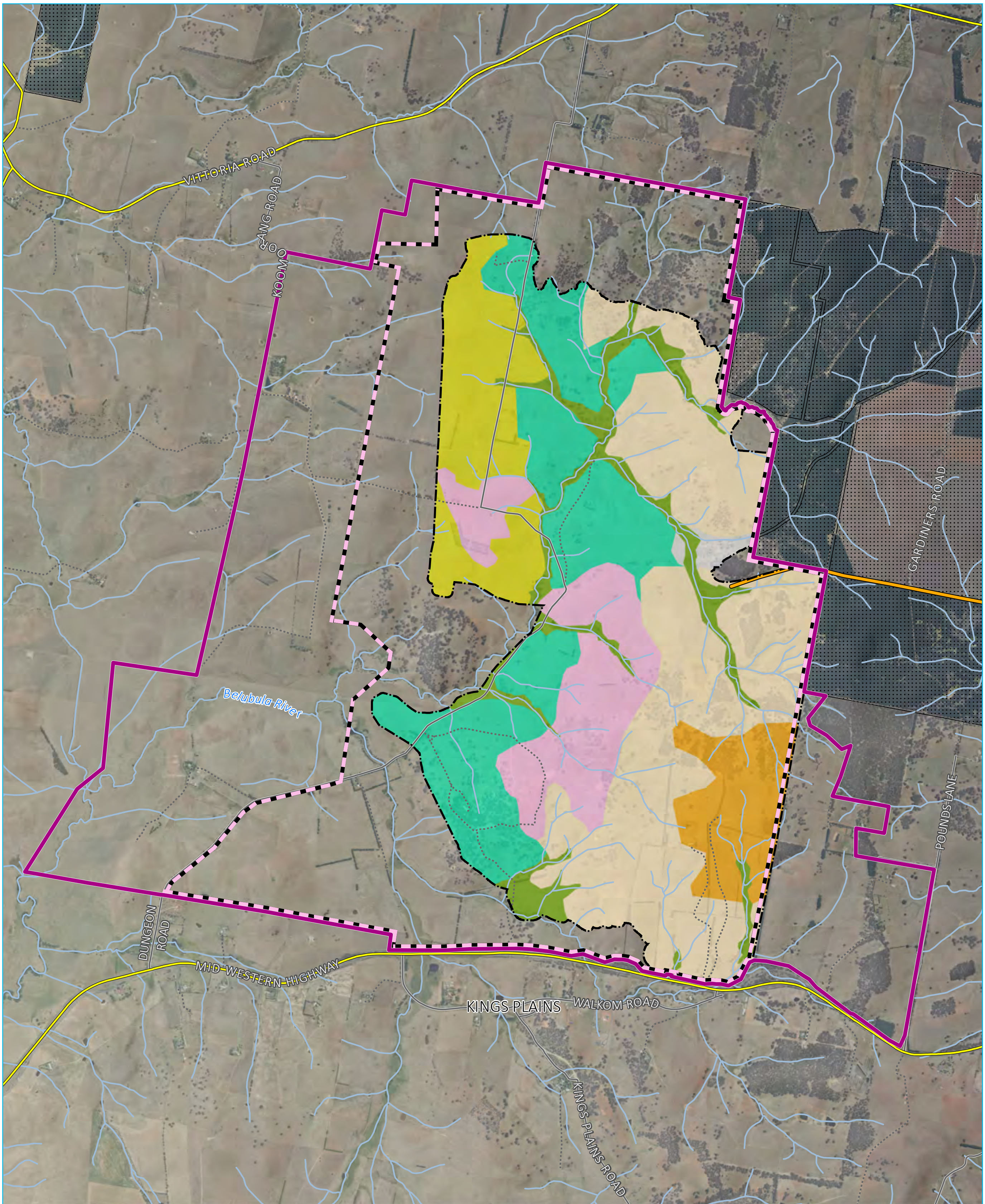
Rehabilitation of land within the disturbance footprint of the mine will require the restoration of a functional soil profile and a landform with slope to drain excess water. The soil profile should supply water, nutrients, aeration and anchorage for plants, as well as some through drainage of water.

The proposed footprint of soil disturbance area is approximately 1,135 ha as shown in Figure 7.5.

7.3.2 Soil Associations within disturbance areas

Soil disturbance will occur on seven of the eight soil associations mapped over the project area as shown in Figure 7.5. Most disturbance will occur on the Upland East, Manganic East and Red Soil Associations.

Typical soil profiles over the project area are strongly stratified and has topsoil that is too sandy and weakly structured to satisfy the topsoiling criteria of Elliott and Veness (1981). However, the organic fraction in the surface 15 cm of soil helps to counteract the poor structural stability associated with the sandy soil topsoil texture. Soil with this organic material will be stripped, stockpiled and respread separately from the underlying soil. This surface layer is described as topsoil in the land capability and soil assessment, and the soil between the topsoil and weathered rock is described as subsoil.



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Source: EMM (2019); Regis Resources (2019); SSM (2019); DFSI (2017); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Soil association
- Alluvium
- Manganic East
- Red Soil
- Sodic Discharge
- Upland Centre
- Upland East
- Upland East-Aluminic

Soil associations in the disturbance footprint

McPhillamys Gold Project
Environmental impact statement
Figure 7.5

Assessment of the soil in 42 test sites in the disturbance footprint found that more than 30 cm of soil is suitable for use as topsoiling material in 75% of sites and more than 50 cm of soil is suitable for use as topsoiling material in 60% of sites.

Constraints to the use of subsoil material in the project area include an elevated sodium, magnesium or soluble aluminium concentration, or the material being weathered rock. Subsoil with elevated sodium and magnesium concentration tends to have low stability, soil with elevated soluble aluminium is toxic to many plants, while weathered rock is generally a poor medium for root growth.

The presence of weathered rock is an absolute constraint, while the chemical constraints of elevated sodium, magnesium and aluminium can be alleviated with ameliorants of gypsum and lime.

The assessment indicated that generally 60 cm can be stripped from much of the disturbance area, and that this soil should be treated with lime to raise the pH. Soil from the 30 to 60 cm layer has a range of chemical constraints that vary across the disturbance footprint. The soil assessment recommends that this variation should be taken into account when stripping, stockpiling and respreading subsoil.

A topsoil balance for the project area has been produced in consideration of the above, outlining recommended stripping depths across the disturbance footprint. This balance is provided in Section 7.4.4.

7.3.3 Post-mining LSC class

The primary goal of the project's rehabilitation strategy is to return disturbed land to a condition that is stable, non-polluting, and supports the proposed post mining land use, which is a mixture of grazing of improved pasture, woodland areas. The final landform shape will be integrated into the current landform. Further discussion on the rehabilitation strategy is provided Chapter 22.

The LSC will be constrained by changes in landform as a result of the project. A larger proportion of the rehabilitated land surface will have a slope that is steeper than 20%, and the top surface of the waste rock emplacement will be more exposed to wind than the current undulating landscape. During rehabilitation works, the soil will be formed from a layer of topsoil placed over a thicker layer of subsoil over either loosened regolith or loosened waste rock.

Table 7.4 summarises the disturbance type, rehabilitation and estimated post-mining LSC classes within the proposed disturbance footprint.

Table 7.4 Mine project area rehabilitation and post-mining LSC class

Infrastructure type	Disturbance and Rehabilitation	Estimated post-mining LSC class
Open cut mine	Construct open cut up to 1,050 m across, and leave as a void.	LSC class 8. No agricultural use possible
Waste rock emplacement - top surface	Man-made landform with some undulations (micro-relief) incorporated into the profile.	LSC class 5. Soil requirements include: topsoil texture sandy loam or finer, stable topsoil structure, soil depth > 50 cm, topsoil pHCaCl2 > 4.0, waterlogging occurs less often than 2 to 3 months every year, exposed to wind.
Waste rock emplacement - batters	Waste rock with 10 cm topsoil cover and 25 cm subsoil.	LSC class 6. Limited by relatively long slope lengths and 1 in 4 batter slope.

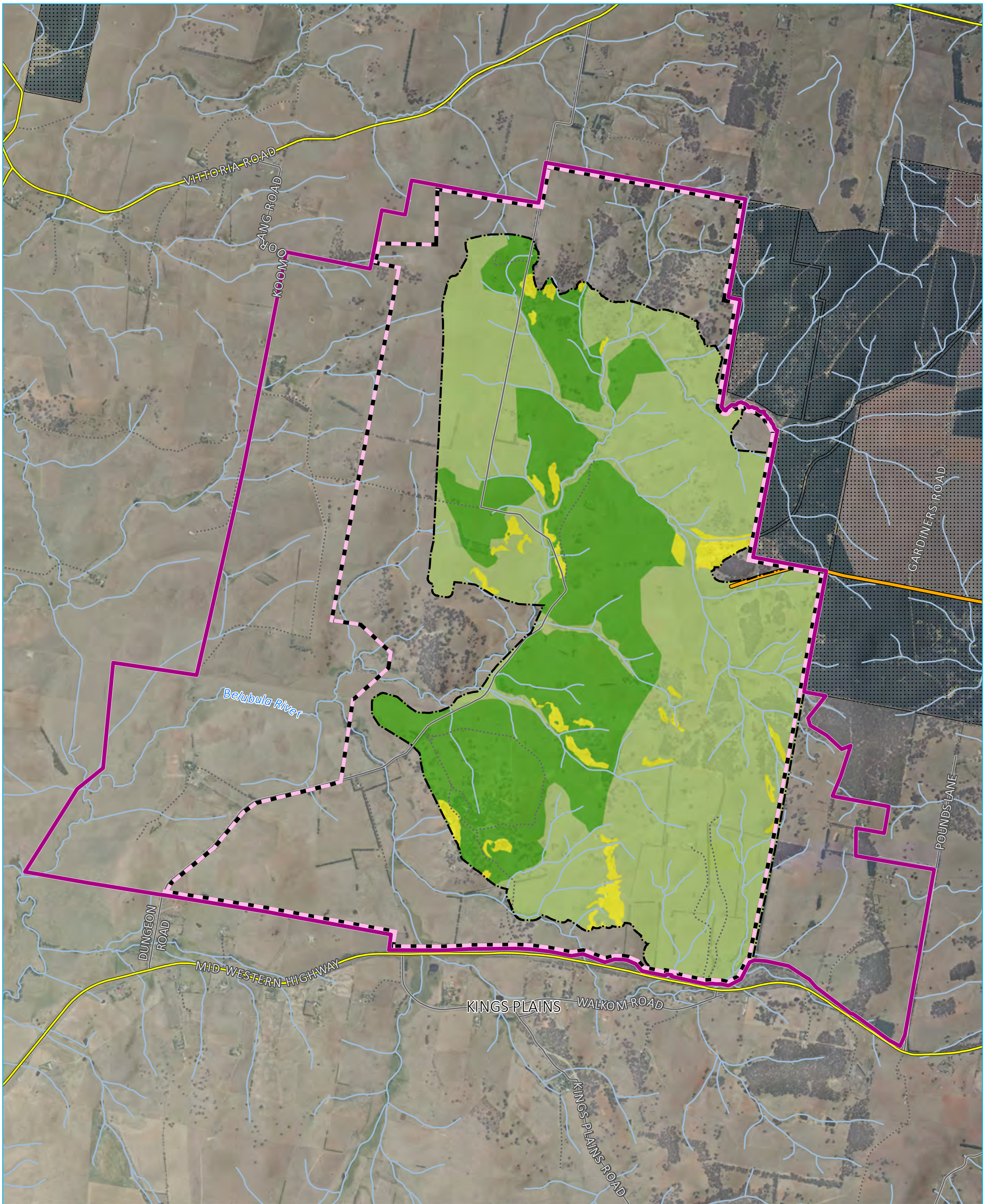
Table 7.4 Mine project area rehabilitation and post-mining LSC class

Infrastructure type	Disturbance and Rehabilitation	Estimated post-mining LSC class
ROM pad	Large level area will be constructed by cutting high areas and filling low areas.	LSC class 6, based on 25 cm soil and loosened subgrade that can be explored by roots and 1: 4 batter slope.
Pit amenity bund	Earthen embankments with topsoil cover and 25 cm subsoil.	LSC class 6, due to 1:5 batter slope.
Tailings Storage Facility- top surface	TSF will be filled, then the tailings will be covered with 50 cm thick trafficking layer, then 60 cm thick subsoil, covered with 10 cm topsoil.	LSC class 4. Soil requirements include: topsoil texture sandy loam or finer, stable topsoil structure, soil depth > 50 cm, topsoil pHCaCl2 > 4.7, waterlogging occurs less often than 2 to 3 months every 2 to 3 years, medium wind exposure.
Tailings Storage Facility- embankments	Earthen embankments with 10 cm topsoil cover and 25 cm subsoil over a rock core.	LSC class 6 due to 1:5 batter slope.
Topsoil stockpile	Topsoil will be stockpiled, then removed and respread.	LSC class should be the same as it was before disturbance provided some amendments are added to restart biological processes that occur in the topsoil, but not subsoil.
Water storage embankments	Topsoil will be stripped, embankments constructed which will remain for the life of the mine, then entirely removed during the rehabilitation phase (with the rock to be used in capping of the TSF and waste rock emplacement) before topsoil is replaced.	LSC class should be the same as it was before disturbance provided some amendments are added to restart biological processes that occur in the topsoil, but not subsoil.
Processing plant and associated infrastructure and laydown yards	Large level areas will be constructed by cutting high areas and filling low areas.	LSC class 6, based on 30 cm soil and loosened subgrade that can be explored by roots.
Roads	Engineered roads will be constructed by smoothing the land surface, compacting the subgrade, then placing a waterproof gravel or asphalt surface.	LSC class 6, based on 30 cm soil and loosened subgrade so that it can be explored by roots.

Table 7.5 summarises the proposed changes in LSC class from pre-mining to post rehabilitation across the project area. Figure 7.6 illustrates the pre-mining LSC classes within the disturbance footprint, and Figure 7.7 shows the post mining target LSC classes within the project area. As shown, the land where capability will mainly be reduced as a result of the project is on the batters of the waste rock emplacement, within the open cut void, and in areas that will be levelled to form a foundation for buildings and roads. Notably, the LSC class across parts of the TSF footprint will be improved from a pre-mining LSC class of 5 to a post-rehabilitation LSC class of 4. This commitment to rehabilitating the TSF final landform to achieve an LSC class of 4 means that there will be only a minimal change in class 4 land across the disturbance area as a result of the project, compensating for the loss of some class 4 land in the footprint of the open cut mine, ROM pad, and other infrastructure areas.

Table 7.5 Changes in LSC classes within the mine project area

LSC Class	Capability	Pre-mining area (ha)	Post-mining area (ha)	Change (ha)
Land with a wide range of uses (cropping, grazing, horticulture, nature conservation)				
1	Extremely high	0	0	
2	Very high	0	0	
3	High	0	0	
Land with a variety of uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)				
4	Moderate	932	920	-12
5	Moderate-low	1491	1080	-411
Land with a limited range of uses (grazing, forestry and nature conservation				
6	Low	86	422	336
Land generally unable to support agriculture (selective forestry and nature conservation)				
7	Very low	4	21	17
8	Extremely low	0	70	70
Total		2,513	2,513	



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Source: EMM (2019); Regis Resources (2019); SSM (2019); DFSI (2017); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

N

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Pre-mining LSC class

- 4
- 5
- 6

Pre-mining land and soil capability in the disturbance footprint

McPhillamys Gold Project
Environmental impact statement
Figure 7.6

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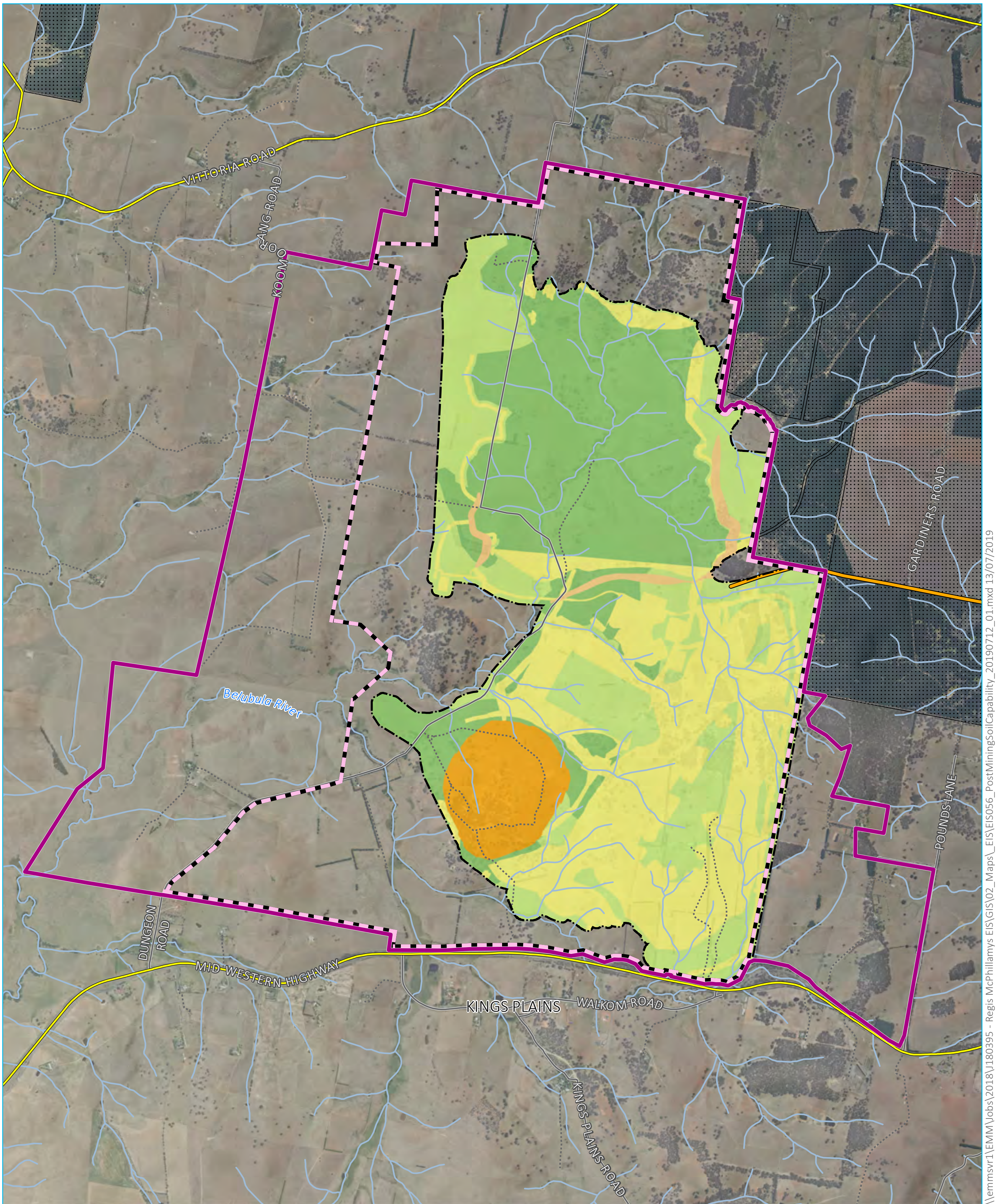
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); SSM (2019); DFSI (2017); ELVIS (2014)

KEY

Project application area

Mine development project area (2,513.47 ha)

Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Disturbance footprint

Pipeline corridor

Existing environment

Main road

Local road

Vehicular track

Watercourse/drainage line

Vittoria State Forest

Post mining LSC class

4

5

6

7

8

Post mining land and soil capability in the disturbance footprint

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Environmental impact statement

Figure 7.7

7.4 Management and mitigation measures

7.4.1 Erosion and Sediment Control

The undulating surface and sandy texture of surface soil in the project area renders it susceptible to water erosion. As a result, soil erosion minimisation practices will be adopted during earthworks, in accordance with the Landcom (2004) publication *Managing Urban Stormwater: Soils and Construction – Volume 1* and DECC (2008) *Volume 2E – Mines and Quarries* (the Blue Book). In addition, drainage structures will be installed to manage water runoff for the life of the project, also in accordance with the Blue Book.

Vegetation will be established on soil stockpiles expected to be in place for more than three months to minimise the risk of water and wind erosion on them.

The greatest risk of soil erosion will be between the time that topsoil is spread and groundcover vegetation is established. Soil erosion and sediment control will also be considered where there is potential for off-site impacts as well as impacts to the rehabilitation.

7.4.2 Soil Contamination

Hydrocarbon management practises will be implemented to prevent hydrocarbon spills during construction, and spill containment materials will be available to clean up spills if they occur.

Waste rock containing PAF material will be placed in an impermeable envelope in the waste rock emplacement, as described in the rehabilitation strategy in Chapter 22.

As mentioned in Chapter 2 (project description), in the event that suitable gravel for the main access road or other earthworks cannot be obtained from within the disturbance footprint during site establishment works, Regis will source the required material from a local quarry. Any construction material brought on to the site will be inspected to ensure it is clean and contaminant and weed free.

7.4.3 Soil Degradation

Compaction of soil during stripping and stockpiling can be minimised by using appropriate machinery and soil movement practices. For example, it is preferable to strip and move soil that is moist rather than being wet or dry. When constructing stockpiles, it is generally better to deposit the soil in lifts of 1 m or more rather than the thin lifts that would be appropriate for constructing embankments or roads.

Degradation of topsoil in the stockpiles is inevitable because deeper layers of the stockpile will have much smaller oxygen supply than is available near the soil surface. Some biological activity in this soil can be maintained by limiting the height of topsoil stockpiles to 3 m and by growing vegetation on these stockpiles. More than 155 ha will be required to stockpile the soil required for rehabilitation with this constraint. Approximately 55 ha has been allocated to topsoil stockpiles within the proposed disturbance footprint, while the remainder of the soil can be stored in the footprint of the waste rock emplacement.

7.4.4 Soil Stripping

An estimated total of 3,813,000 m^3 soil will be required for rehabilitation works throughout the mine life, consisting of 872,000 m^3 of topsoil and 2,941,000 m^3 of subsoil. The soil volume calculations undertaken during the soil assessment indicate there is 1,243,000 m^3 of topsoil and 3,412,000 m^3 of subsoil available to be stripped and salvaged for rehabilitation. This indicates a substantial surplus of 371,000 m^3 of topsoil and 748,000 m^3 of subsoil material. Table 17 in the *Land and soil capability assessment* (SSM 2019a, Appendix H) presents a complete topsoil balance for the mine.

The soil assessment recommends that the surface 15 cm of soil is stripped across the disturbance footprint and stockpiled separately to the underlying subsoil. A minimum of approximately 10 cm of topsoil is to be returned on the rehabilitated landform; hence some allowance has been made in the stripping depth for topsoil losses during stripping, stockpiling and rehandling. The topsoil and subsoil will be stockpiled separately because the material with the lowest potential to be topsoil is the layer immediately below the topsoil. Bleached A2 horizons were found in 40% of the 42 pits sampled in the area of the proposed disturbance. Bleached A2 horizons were uncommon in the Red Soil Association but sampled in 35 to 40% of sites in the Manganic East, Upland centre and Upland East Associations. This bleached layer could be used as subsoil with care.

The following topsoil stripping and handling techniques will be implemented where practicable to minimise soil deterioration:

- The area to be stripped will be clearly defined on the ground. The target depths of topsoil and subsoil to be stripped at each location will be clearly communicated to machinery operators and supervisors.
- A combination of suitable equipment will be used for stripping and placing soil in stockpiles. Machinery circuits will be located to minimise compaction of both undisturbed and stockpiled soil.
- The soil material will be maintained as much as possible in a slightly moist condition during stripping. Material will not be stripped in either an excessively dry or wet condition.
- All machinery brought onto the site for soil stripping will need to comply with weed management and biosecurity protocols established for the site.
- Trees present will be cleared and grubbed prior to soil stripping.
- Handling and rehandling topsoil will be minimised as far as possible.

As noted in identified in Section 7.2.1, the project area contains a low risk of the presence of naturally occurring asbestos. Regis will follow appropriate procedures for naturally occurring asbestos as recommended by SafeWork NSW and in accordance with Regis' naturally occurring asbestos procedure.

7.4.5 Soil Stockpiling

The topsoil will be stored in a way that minimises compaction of the whole stockpile and maximises biological activity. The following techniques will be implemented where practicable to achieve these goals:

- Stockpiles will be located far enough from drainage lines and dams that they are not washed away.
- Topsoil and subsoil should be stockpiled separately. Where this is not possible, combined topsoil and subsoil stockpiles will be built to the specifications of topsoil stockpiles.
- All soil stockpiles will have batter slope of 1V:4H to limit erosion potential.
- Topsoil stockpiles will be designed and constructed to a depth not greater than 3 m in order to minimise the development of anaerobic conditions and to minimise the deterioration of biota and seed banks.
- Subsoil stockpiles can be up to 4 m high.
- The surface of soil stockpiles will be left in a rough condition to promote water infiltration rather than runoff. If required, sediment controls will be implemented downslope of stockpiles to capture eroded sediment.

- Overland flow onto and across stockpile sites will be kept to a practical minimum, and not allowed to concentrate to the extent that it causes visible erosion. This will be achieved by placing stockpiles on locally high areas.

- Stockpiles will be seeded with appropriate grasses and forbs to stabilise the surface, limit dust generation, minimise erosion and provide competition for weeds.

- After the stockpiles are established, machinery and vehicles will be excluded from general access. Stockpile location will be marked on site maps to identify them so that they are protected from disturbance.

- Stockpiles will be surveyed and data recorded about the volumes and soil types present.

- Stockpiles will be monitored for the establishment of weeds and control programmes implemented as required.

- Soil transported by dump trucks may be placed directly into storage. Soil transported by bottom dumping scrapers is best pushed to form stockpiles by other equipment (such as a bulldozer or excavator) to avoid tracking over previously laid soil by the scraper.

7.4.6 Soil Respreading

The aim of respreading is to construct a layered material with properties that can perform similar functions to the undisturbed soil. Topsoil provides a path for entry of water and air, storage of nutrients and water, and plant support. Subsoil should have continuous pores to allow entry of water and air as well as root growth. Subsoil has a larger role in storage of water than nutrients and is important in supporting plants. The soil should not have large differences between the properties of layers as the discontinuities at these boundaries can slow water movement. The spreading of topsoil and subsoil should be carried out to achieve these aims. The recommended process for spreading of topsoil is as follows:

- A soil balance plan showing the depths and volumes of soil to be spread will be prepared before the soil is spread. The plan will take account of the erodibility of the stockpiled soil, with more erodible soil being placed on flatter areas to minimise the potential for erosion.

- Stockpiled topsoil and subsoil will be tested to determine the required ameliorants.

- After decommissioning, laydown yards, infrastructure areas and roads to be decommissioned will be ripped.

- The land surface will be reshaped to appropriate landforms.

- A second ripping may be required after the surface is reshaped.

- Ameliorants will be mixed with the soil as it is being spread if required.

- Subsoil will be spread in even layers at thickness appropriate for the desired land capability, then topsoil will be spread.

- Soil will be moist to just moist rather than wet or dry when being respread.

- Traffic patterns will be managed to minimise compaction of topsoiled areas.

- Soil will be lightly scarified to encourage rainfall infiltration.

- Pasture will be seeded as soon as possible after soil is respread.
- Erosion and sediment controls will be implemented where necessary prior to vegetation establishment.

7.4.7 Monitoring and Reporting

As described in the above sections, the successful restoration of soil in the project area will depend on the following key steps:

1. Stripping and stockpiling sufficient soil to provide topsoil and subsoil for the area to be rehabilitated.
2. Maintaining biological activity and adequate aeration in the stockpiled soil.
3. Preparation of the subgrade and construction of the rehabilitated soil.
4. Establishment of desired plants on the rehabilitated soil.

All these steps will require some degree of monitoring. It is likely that steps 1 and 3 will require the most intensive monitoring, and annual monitoring of vegetation health, groundcover percentage, weed presence, gully erosion presence, soil subsidence and water pooling is recommended.

A detailed rehabilitation and monitoring plan will be developed for approval as part of the MOP, prior to the commencement of the project, and will include the following:

- Monitoring of stripping and stockpiling will ensure that the design depth of topsoil is stripped and that the subsoil is soil rather than weathered rock. The volumes of topsoil and subsoil will be checked to ensure that there is sufficient soil to enable the planned rehabilitation.
- Maintenance of biological activity will require plants to be grown. The species and vigour of plants growing on the stockpiles will be monitored.
- The soil stockpiles will be tested before the soil is spread to determine the ameliorants required to construct a fertile soil profile. It is likely that nutrients will be required in the topsoil, and some lime will be required in most soil that is spread. Some gypsum may also be required, but the results of the soil assessment indicate that this is only for the soil to be stripped in the 60 to 100 cm soil layer in the footprint of the TSF.
- Achieving the planned LSC class depends on accurate placement of the subsoil and topsoil. Achieving the desired soil thickness will in turn depend on accurate preparation of the subgrade. As such, an accurate survey of the thickness of the soil layer will be conducted.
- The monitoring of rehabilitation success will be undertaken and determined by the plant growth in the rehabilitated landscape.

7.5 Conclusion

Up to 1,135 ha of land will be disturbed to develop and operate the mine. This will result in some changes to the land and soil capability class across the project area compared to the existing landscape; primarily a reduction in LSC class 5 land and an increase in land with an LSC class of 6. The land within the mining lease application area is verified non-BSAL.

The mine development will result in the temporary removal of agricultural land within the disturbance footprint. The existing LSC classes across the project area comprise mainly class 4 and class 5 land. Upon completion of mining all surface infrastructure will be removed and the area rehabilitated to a condition that is stable and supports the post mining land use, which is typically grazing.

Post mining, the rehabilitation landform will predominantly be a combination of class 4, class 5 and class 6 land. Notably, the LSC class across parts of the TSF footprint will be improved from a pre-mining LSC class 5 to a post-rehabilitation LSC class 4. This commitment to rehabilitating the TSF final landform to achieve an LSC class of 4 means that there will be only a minimal change in class 4 land across the disturbance area as a result of the project. The change in land and soil capability classes in the project area post-mining will be as follows: a reduction in LSC class 4 by 12 ha, a reduction in LSC class 5 by 411 ha, an increase in LSC class 6 by 336 ha, an increase in LSC class 7 by 17 ha and an increase in LSC class 8 by 70 ha (associated with the open cut void). Therefore, the majority of the site will be suitable for the continuation of agricultural land use post mining.

The soil resources on site will be stripped, stockpiled and managed to provide a post mining growth medium and re-establishment of an appropriate soil profile. There is a surplus of both topsoil and subsoil material to meet the nominated LSC classes on the post mining landform. The mine will be progressively rehabilitated to the final landform design.


Chapter 8

Agricultural resources



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8 Agricultural resources

8.1 Introduction

This chapter provides a summary of the Agricultural Impact Statement (AIS) (SSM 2019c) prepared for the mine development, which is presented in full in Appendix I. The AIS assessed the potential impacts of the mine development on agricultural resources and/or industries within and surrounding the mine project area. This chapter presents the assessment methodology, the existing agricultural environment and potential impacts from the mine development on this environment and the measures to avoid, manage and mitigate those potential impacts.

The relevant environmental assessment requirements relating to the assessment of potential agricultural related impacts are summarised in Table 8.1.

Table 8.1 Agriculture related EARS for the mine development

Requirement	Where addressed
Land	
• the likely agricultural impacts of the development, including identification of any strategic agricultural land;	This chapter, and Appendix I. An SVC was issued for the mine development (refer to Appendix C), confirming there is no BSAL in the mining lease application area.
• the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007, paying particular attention to the agricultural land use in the region	A discussion on the requirements of the Mining SEPP is provided in Chapter 3. The compatibility of the development with surrounding land uses is also discussed in Chapter 38 (project justification). The impacts of the project are summarised in Section 8.3.

The assessment also considered relevant government guidelines and policies; namely:

- *Strategic Agricultural Land Use Policy: Guideline for Agricultural Impact Statements* (DPE 2015) (the AIS guidelines); and
- *Agricultural Impact Statement technical notes: A companion to the Agricultural Impact Statement guideline* (DPI 2013a) (the AIS technical notes).

To enable all requirements as set out in the EARs related to agriculture, and the AIS guideline and AIS technical notes to be addressed, a comprehensive methodology was applied to the AIS. Relevant aspects from various studies were considered in the assessment including soils, water, rehabilitation and economics. The methodology included:

- detailed database searches and mapping review, such as ABS Agricultural Census Data, and DPE, OEH and NSW Agriculture mapping;
- review of publicly available information including tourism and agricultural industry publications, and real estate advertising;
- reference to the *McPhillamys Gold Project - Biophysical Strategic Agricultural Land Verification Assessment* (SSM 2019b);

- consultation with water engineers, soil scientists, geochemists, land management specialists, rehabilitation and closure specialists and agro-economists and, ultimately, the Land Capability and Soil Assessment (included as Appendix H), Water Assessment (refer to Chapter 9), Geochemistry Assessment (refer to Chapter 9), Rehabilitation and Landscape Management Strategy (Refer to Chapter 22) and the Economic Assessment (Chapter 36) that form part of this EIS; and

- review of other relevant assessments forming part of this EIS including the Traffic and Transport Assessment (refer to Chapter 17), Biodiversity Assessment (Chapter 13), Visual Assessment (Chapter 19) and Social Assessment (Chapter 20).

8.2 Existing environment

8.2.1 Biophysical Strategic Agricultural Land

As described in Chapters 3 and 7, a soil assessment was undertaken within the mine project area in accordance with the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH and OAFS, 2013). This assessment found no BSAL within the mining lease application area. Subsequently a Site Verification Certificate was issued for the project by the DPIE on the 18 June 2019.

8.2.2 Agricultural setting and enterprises

i Historical Agriculture

Grazing of livestock has been the main agricultural land use within the locality since the area was first settled in the 1820s. This historic land use is consistent with the LSC assessment of the mine project area, as outlined in Chapter 7.

All of the mine project area, with the exception of one property for which an option to purchase has been agreed to with the current landholder, is owned by Regis. Regis also own some adjoining land to the north of the project area (refer Figure 5.5). All of this land is currently used for agriculture. Based on interviews with landholders, the main agricultural use of land over the last 10 years has been grazing of beef cattle on unimproved (native) pastures which have had applications of superphosphate and in some cases sub clover. Two of the properties ran sheep in addition to cattle. These two properties had established improved perennial grass/sub clover pastures and regularly grew small areas of oats for fodder. One of the properties that only ran beef cattle had established some improved pastures.

ii Agricultural enterprises and support infrastructure

The major transport routes used by agricultural producers in the region to access supporting services and to move their products include the Mid Western and Mitchell Highways, major local roads such as Millthorpe Road, and local roads such as Guyong, Vittoria and Dungeon Roads.

Agricultural industries in the locality of the mine development are supported by a range of general and specialist infrastructure and services.

- The Central Tablelands Livestock Exchange is located 10 km south-west of Blayney and is the main livestock selling centre for the central tablelands area of Orange, Blayney, Bathurst, Oberon, Molong, Canowindra and Cowra (Blayney Shire Council, 2018). In 2018 there were 442,868 sheep and 163,993 cattle sold through the Central Tablelands Livestock Exchange (MLA, 2019).

- Businesses in Blayney provide agricultural support services including machinery sales and service, farm supplies (animal health, seed, fertiliser, chemicals, fencing materials), stock and station agents, veterinary practices, agricultural consultants and professional services (legal and accountancy).

- Orange and Bathurst are large regional centres located within 40 km of Blayney that also provide the above support services to the locality.

Blayney Shire has a total land area of 152,465 ha and a population of 7,344. Agriculture is the main employing industry, accounting for 12.7% of the 3,222 people employed in the shire (ABS 2017).

Agriculture accounts for 132,592 ha (88%) of the land use in the Blayney Shire (ABS, 2012a). Grazing of improved pasture is the dominant agricultural land use, accounting for 95,960 ha (72 % of land used by agriculture), followed by grazing of other lands 28,778 ha (22% of land used by agriculture) (ABS 2012a). Less than 5% of the land used by agriculture in Blayney LGA is cropped (ABS 2012a).

More agricultural businesses run beef cattle than sheep, although some business run both. There are a very small number of businesses involved in the production of dairy cattle, wine grapes or other horticultural enterprises.

In addition to grazing of sheep and cattle there are a small number of landholders who run other agricultural operations in the locality of the mine project area, as illustrated in Figure 5.6 (refer to Chapter 5). Forestglen alpaca stud farm is approximately 3 km west of the project area. Some rural residences in Kings Plains also keep horses, including a property directly south of the mine project area off the Mid Western Highway that buys and sells horses to the export market. Cottesbrook Honey is located on Kellys Road approximately 2 km south-east of the project area, and Goldfields Honey is produced at the Beekeepers Inn, approximately 3 km to the north-east. There is a small retail nursery in Kings Plains. Numerous vineyards are also located on the western and southern fringes of Orange, to the north-west of the mine project area. In addition, commercial forestry production is undertaken in the adjacent Vittoria State Forest.

iii Agriculture production values

The gross value of agriculture production in the Blayney LGA was $47.2 million in 2015/16, which represents 0.36% of the gross value of agriculture production in NSW for that period. Beef cattle production is the highest value agricultural industry in the Blayney LGA and accounted for 55% ($25.9 million) of the gross value of agriculture production in 2015/16 (ABS 2018).

Other agricultural industries in the LGA include wool (13%, $6.3 million), sheep and lambs for meat (10%, $5.1 million), milk (6.4%, $3 million, hay production (5.7%, $2.7 million) and cereals (5.5%, $2.6 million) (ABS 2018). The relative contribution of the different agricultural industries to gross value of agricultural production in Blayney in 2015/16 is comparable to those achieved in 2010/11.

8.3 Impact assessment

8.3.1 Risk assessment and overview of impacts

A risk assessment was conducted as part of the preparation of the AIS to identify potential risks to agricultural land resources from the mine development. It followed the process outlined in the *Guideline for Agricultural Impact Statements at the Exploration Stage* (NSW Government 2015a).

The impact assessment considered:

- existing land capability and agricultural uses, as outlined in Chapter 7;

- the area and length of time that agricultural resources will be impacted by the mine development; and

- proposed final landforms, land and soil capability and land uses.

The highest risks to agricultural production, if left unmitigated, were identified as:

1. overflows from water management facilities in the mine project area resulting in the pollution of water used for agricultural purposes downstream of the project area;

2. seepage from the TSF contaminating groundwater; and

3. erosion of landforms, resulting in sedimentation of waterways, or failure of the final landform.

The proposed management and mitigation measures to ensure these risks are effectively reduced to low are presented in Table 8.2.

Table 8.2 Potential risks to agriculture from the mine development and mitigation measures

Aspect	Management and mitigation measures
Overflows from water management facilities resulting in the pollution of water used for agricultural purposes downstream of the project area.	Adequately and conservatively sized water management facilities, run-off containment systems, appropriate storage of fuel and other contaminants, clean water diversions. Water management plans (surface and groundwater) will be developed and implemented for the construction and operational phase of the mine development. These will include monitoring programs with trigger action response plans.
Seepage from the TSF contaminating groundwater.	A robust, peer reviewed design by suitably qualified engineers has been developed for the TSF. The TSF has been designed specifically to avoid adverse impacts to the surrounding environment. A seepage interception drain and seepage interception bores will be installed downstream of the TSF to ensure that any seepage is captured early and mitigation measures can be put into place. In addition, as described in Chapter 9, any seepage that may migrate from the TSF will have concentrations below the observed existing surface water quality concentrations, ANZECC (2000) livestock drinking water guideline values and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values. Water management plans (surface and groundwater) for the construction and operational phase of the mine development will be developed and implemented. These will include monitoring programs with a trigger action response plan.
Erosion of landforms, resulting in sedimentation of waterways, or failure of the final landform.	The waste rock emplacement landform has been designed to minimise erosion risk. Erosion modelling undertaken of the proposed waste rock emplacement landform found a low risk of erosion (refer to the Rehabilitation and Landscape Management Strategy for the mine development (Appendix U and Chapter 22)). An erosion and sediment control plan will also be developed and implemented in accordance with the Blue Book (Landcom 2004 and DECC 2008). Soil erosion minimisation practices will include establishment of vegetation cover on stockpiles and progressive rehabilitation of disturbed areas, particularly water management facility embankments and the waste rock emplacement.

Further to the above mitigation measures, it is noted that the change in land use across the majority of the mine project area will be temporary. At the cessation of mining, this land will be rehabilitated and the pre-mining agricultural land-use restored across the majority of the project area. Of the approximate 1,135 ha to be disturbed by the mine, around 70 ha (or 6%) will be permanently removed from agricultural production associated with the final void. Further details on the post-mining land capability are in Chapter 7 (soil resources).

Notably, land to be disturbed by the mine development is either owned by Regis, or under an option agreement for Regis to purchase. There is no other privately-owned land that will be directly disturbed by the mine development.

8.3.2 Water resources

i Groundwater

As described in Chapter 2, prior to the commissioning of the pipeline which expected by the end of Year 1, construction water will be sourced from a combination of rainfall runoff captured in accordance with Regis' harvestable rights entitlement and groundwater bores. Regis has secured groundwater licences, totalling 400 shares, in the Lachlan Fold Belt Murray Darling Basin Groundwater Source. Potential shortfalls will be managed by investigating alternative water supplies, such as establishing production bores or purchasing and trucking water to site and reducing haul road dust suppression water demand by the use of dust suppression agents.

During mine operations water will be principally sourced externally from Centennial's Angus Place Colliery and Springvale Coal Services Operations, and Energy Australia's Mt Piper Power Station near Lithgow. A new 90 km pipeline will supply this surplus water to the mine. The supply of water from these locations will enable a beneficial use of otherwise surplus water from mining in the Sydney Basin, and provide this as a reliable water source for the mine development. This also means that the mine will not principally rely on other water sources from within or surrounding the mine project area that are used for agricultural production.

In relation to impacts on groundwater as a result of the mine development, the groundwater model predicts that groundwater levels at existing privately-owned bores in the vicinity of the mine will experience little to no change as a result of the mine development. No bores will experience a cumulative pressure head decline of greater than 2 m, which the NSW *Aquifer Interference Policy* (DPI 2012) defines as 'minimal impact'.

The groundwater model predicts that the mine will have an insignificant impact on changes to spring flows outside the project area. The models also predict that with the implementation of the proposed management and mitigation measures, the risk of the mine development impacting on groundwater quality is insignificant. As noted in Table 8.2 and described in Chapter 9, even without all the designed seepage management measures in place in the TSF, any seepage that may migrate from the TSF will have concentrations below the observed existing surface water quality concentrations, ANZECC (2000) livestock drinking water guideline values and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values.

As the mine will have a minimal impact on groundwater availability at private bores and an insignificant impact on groundwater quality it will not adversely impact agricultural groundwater use in the vicinity of the mine project area.

ii Surface water

The water management system has been designed so that the mine will be a nil discharge site. Water management facilities/dams have been conservatively sized so that this is the case, and therefore the risk of any overflows off site and impacting on downstream water users is low. The use of surplus water from Centennial Coal's mining operations and MPPS as the principle water supply for the mine development also significantly reduces the water to be used by the mine development that could otherwise be used for agriculture.

The main potential surface water impact during the operational phase of the mine development is the reduction in streamflow in the Belubula River, and thus a reduction to inflows into Lake Carcoar due to catchment excision associated with the mine disturbance footprint. During the operational phase of the mine, median annual inflows are anticipated to be reduced by around 242 ML/yr in Carcoar Dam. This represents 4% of mean annual flows into the dam and will therefore not significantly reduce water available for other users. During the post-closure phase, following rehabilitation, median annual inflows will be reduced by 28 ML/yr (0.47%) when compared to the existing situation. This level of change in streamflow is expected to be minor in comparison with the natural variability in catchment conditions. A detailed discussion on the predicted changes to streamflow is provided in Section 9.5.4 in Chapter 9.

Chapter 9 also describes in detail the measures incorporated into the design of the mine, including the management of PAF material and the TSF, so that significant impacts to water quality do not occur.

8.3.3 Land and soil capability

As described in Chapter 7, the mine development will result in the temporary removal of agricultural land within the disturbance footprint, comprising approximately 1,135 ha. Post-mining, the disturbance of land within the mine project area will result in some changes to the land and soil capability class compared to the existing landscape; primarily a reduction in LSC class 5 land and an increase in land with an LSC class of 6. Therefore, the majority of the mine project area will be suitable for the continuation of agricultural land use post mining. Land with an LSC class of 6 can be used for grazing and improved pasture, but the land will require careful management to prevent severe land and environmental degradation. The void created from excavating the open cut mine will have no agricultural value.

The changes in LSC class from pre mining to post mining are described in detail in Table 7.5 in Chapter 7.

8.3.4 Agriculture production values

The main impact of the mine development on agricultural resources will be the removal of grazing livestock from disturbed land during the life of the mine, and the reduced carrying capacity of some land after the site is rehabilitated due to the predicted change in LSC class described in Section 8.3.3. As such, the impact assessment considered changes on stock numbers before, during and after the mine development.

The mine development will disturb a maximum area of approximately 1,135 ha, which will temporarily be removed from agricultural use. The uses to which this land will be put during mine operation are depicted in Figure 2.1 (mine site layout). The disturbance area accounts for less than 1% of the 132,592 ha used for agriculture in the Blayney LGA (ABS, 2012a). Further, more than half of the 2,513 ha mine development project area (ie 1,377 ha), will remain undisturbed by the mine development during operations, with the majority of this land to continue to be used for agricultural (grazing) purposes. In many cases this land will be leased back to the original owner/leasee.

To estimate the loss in value of agricultural production from this change in carrying capacity during the operational phase of the mine, the gross margin for the predominant livestock enterprise (inland store weaners) was taken from the farm budgets compiled by NSW DPI (2019). The inland store weaner budgets give a gross value of production of $40.36 dry sheep equivalent (dse) and a gross margin of $32.45 dse. Based on a reduction in carrying capacity of 10,064 dse, the net value of agricultural production will decline by $406 193/yr during the life of the mine. This equates to just under 1% of the $42.7 million of gross value of agriculture production in the Blayney LGA in 2015/16 (ABS 2018).

Post-mining, the primary objective of the mine's rehabilitation strategy (EMM 2019b) is to return disturbed land to a condition that is stable, non-polluting, and supports the proposed post-mining land use, which is a mixture of grazing on improved pasture and woodland areas.

Using the assumptions for carrying capacity associated with LSC classes outlined in the AIS (Appendix I), it is calculated that the carrying capacity of the mine project area will be 2,362 dse/yr lower post mining than it was before mining. Based on this change in carrying capacity and the inland store weaner budgets used in the AIS, the annual gross value of agriculture production from the mine project area will be $95,373 lower after the mine development than before. This equates to 0.2% of the $42.7 million gross value of agriculture production in Blayney LGA in 2015/16 (ABS 2018).

8.3.5 Local and regional employment

The mine disturbance area accounts for less than 1% of the land currently used for agriculture in the Blayney LGA. Consequently, there will only be a negligible reduction in the demand for agriculture support services available in Blayney as a result of the mine development, which include machinery sales and service, farm supplies (animal health, seed, fertiliser, chemicals, fencing materials), stock and station agents, veterinary practices, agricultural consultants and professional services (legal and accountancy).

Local labour sources for the mine development will be provided by workers within a one-hour travel time from the mine site. This area includes the Blayney, Bathurst, Cabonne, Cowra and Orange LGAs.

The agricultural industry employs 3,045 people across the Blayney, Bathurst, Cabonne, Cowra and Orange LGAs, which accounts for 6.1% of regional employment (ABS 2018). In the Blayney LGA 12.6% of employees work in agriculture, 18% in Cabonne, 17.1 % in Cowra, 3.8% in Bathurst and 2.2%in Orange. As is the general case for agriculture, the agricultural workforce in the region is dominated by older workers with 47% of the workforce aged over 55 years. The predominant occupation of agricultural industry workers is managers (58.9%), followed by labourers (20%) and technicians and trade workers (7.2%).

The project (including both the mine and pipeline development) is anticipated to have a peak construction workforce of approximately 710 FTE workers. During operations, an average workforce of around 260 FTE employees will be required, peaking at approximately 320 FTEs in around years four and five of the project.

A proportion of the construction and operational phase workforces will be drawn from outside the Blayney LGA in the neighbouring LGAs of Orange, Bathurst, Cowra and Cabonne, with a small portion also drawn from Lithgow. Bathurst and Orange LGAs each have a significantly large labour force and a sizeable pool of unemployed labour. Outside of the Blayney LGA and except for the Cowra LGA, all LGAs within the local area have unemployment rates equal to or below the Central West and Orana Region (CW&O) of 5.2%. Additional labour will also be drawn from outside the CW&O Region.

The SIA prepared for the mine development (Hansen Bailey 2019) considered the risk of the project displacing other economic sectors, such as the agricultural sector, by taking up a sizeable portion of the employed and unemployed labour pool during both construction and operation, and through inflationary impacts on wages, trades and services. This impact is likely to be most significant during the construction phase due to the size of the project workforce and the likely capital expenditure during the construction phase. The construction phase of the project is likely to draw on the labour pool associated with a range of trades including mechanics, electricians, welders and labourers.

A Labour Market Study carried out by Hansen Bailey (2018) reported on a workforce characteristics study conducted at the nearby Cadia Valley Operations (CVO), which found that the most common occupation prior to joining CVO were trades works (31%), plant or equipment operators (23%) and general labourers (14%). 13% of CVO staff were previously employed in the agriculture, forestry and fishing sector.

The impact of the mine development on local labour supply will be influenced by the potential demand for local hires and the number of flow-on jobs generated in the Blayney LGA and the local area the project. Regis has committed to employing as many local residents of the Blayney LGA as possible. However, the company acknowledges it will need to monitor project labour demands and any potential adverse impacts on the non-mining sector. Regis will remain informed of labour market changes and will adjust local hire numbers accordingly.

8.3.6 Other agricultural enterprises in the area

As described in Section 8.2.2ii, agricultural enterprises in the vicinity of the mine project area include:

- honey production - Cottesbrook Honey is approximately 2 km south-east of the project area, and Goldfields Honey at the Beekeepers Inn is approximately 3 km to the north-east;
- grazing of sheep and cattle;
- alpacas - Forestglen alpaca stud farm is approximately 3 km north-west of the mine project area;
- horses - some rural residences in Kings Plains also keep horses, including a property directly south of the mine project area off the Mid Western Highway that buys and sells horses to the export market;
- commercial forestry production in the Vittoria State Forest; and
- vineyards - are located on the western and southern fringes of Orange, to the north-west of the mine project area.

The potential impact on these agricultural uses is considered below.

i Honey production

Potential impacts to apiarian activities in the vicinity of the mine project area could include:

- a loss of habitat in the mine project area as a result of vegetation clearance activities; and
- impacts on water resources used by the bees, and the potential for cyanide toxicity from TSF water.

Hives of honey bees are periodically placed within or adjacent to the Vittoria State Forest, which is east of the proposed TSF. However, pine pollen is understood to be of poor quality for honey production and it is unlikely that the honey producers rely solely on the State forest for the production of honey.

Box Gum woodland in the mine project area is therefore understood to provide pollen for the bees managed by local producers. The Biodiversity Assessment Report (refer to Appendix N) found that the mine development will result in a reduction of around 1.68% in the extent of Box Gum Woodland within a 5 km radius of the mine project area. It is therefore anticipated that the mine development will not result in a significant loss in foraging habitat for bees. Also, a large area of Box Gum woodland in the northern part of the mine project area has been avoided by the design of the TSF and will therefore remain throughout the mine life for use by the bees.

In relation to water sources, bees collect freshwater for use in the hive, for thinning honey and larval food, and in the regulation of temperature and humidity within the hive. Because of the energy required to transport water to the hive, bees will preferentially source water close to the hive. Water sources for bees include drops on plants such as guttation (water exuded from leaves) and dew (Girolami et al. 2009), or from surface water bodies such as puddles, pools, creeks or dams. Bees are susceptible to drowning in large water bodies and therefore prefer small areas of slightly dirty water where they can land safely at the edges. It is therefore considered unlikely that the bees would use the TSF as a water source given their general avoidance of large bodies of water.

In relation to cyanide concentrations in the TSF, the detoxification process will break down cyanide (CN) from the more toxic form (HCN) to low concentrations in the tailings of weak acid dissociable (WAD) cyanide and total cyanide. As described in Chapter 2 (Section 2.8.8), the tailings slurry that is produced during processing of the ore will be treated in a cyanide detoxification circuit, where oxygen and other reagents (lime, copper sulphate and sodium meta-bisulphite) are added. The reagents react with the free and WAD cyanide in the thickened slurry, so that the free cyanide is destroyed and the level of WAD cyanide remaining is reduced to less than 30 parts per million (ppm) (30 mg/L).

Cyanide levels of 50 mg/L WAD in storages accessible to terrestrial wildlife is accepted as the water quality benchmark for the protection of wildlife (International Cyanide Management Institute 2018 and Donato et al. 2007).

ii Sheep, cattle, horses and alpacas

Grazing of sheep and cattle is a common land use surrounding the mine project area. An alpaca stud is situated to the west of the mine project area and a small number of residences also keep horses in Kings Plains. The impact on these residences and businesses was considered particularly with respect to blasting in the Noise and Vibration Assessment of the mine development (refer to Appendix L). The assessment concluded that overpressure and vibration levels from blasting activities at the mine will be well below the regulatory criteria and considerably lower than other sources of overpressure that horses or livestock are likely to be already subjected to, such as lightning strikes which are typically between 120dBZ and 130dBZ. The blasting assessment modelled the maximum instantaneous charge (MIC) for blasts within the open cut to ensure that the regulatory criteria for air blast overpressure and vibration at nearby properties are met. This MIC is 300 kg, which Regis have committed to incorporating into blast designs for the mine.

In relation to air quality, as described in Chapter 11 the dispersion modelling conducted as part of the air quality assessment concluded that emissions to the atmosphere from the mine will be well within the relevant EPA criteria. No significant offsite impacts to surrounding land uses is anticipated in relation to air quality.

iii Vineyards

There are a number of vineyards around Orange, particularly on the southern side, more than 20 km from the mine project area. Given the distance from the mine to these vineyards, no impacts are anticipated on these vineyard and winery businesses.

iv Commercial forestry

The Vittoria State Forest is adjacent to the mine project area on the eastern side. Potential impacts on forestry activities that are conducted by the Forestry Corporation of NSW in the State Forest have been considered as follows:

- Air quality – the predicted dust levels in the Vittoria State Forest can be seen in Figures 11.7 to 11.22 (air quality contours) in Chapter 11. As shown, the incremental (ie mine related) dust levels in the state forest resulting from the mine will be low.
- Groundwater – as shown in the groundwater level contours presented in Figure 9.18 and Figure 9.19, the drawdown in groundwater levels as a result of mining in the open cut will remain close to the open cut void. Drawdown is not expected to impact on the State Forest.
- Surface water – the state forest is upstream of the mine site. There is therefore no risk of any offsite discharges affecting the State Forest.
- Flooding – as described in Section 9.5.6, because the mine development is in the headwaters of the catchment, any localised flooding impacts that occur as a result of changes to the land surface from the mine development will be confined to land owned by Regis.
- Traffic – the traffic impact assessment concluded that the surrounding road network has sufficient capacity to accommodate existing and mine development-related traffic, as well as the estimated cumulative background traffic levels over the 15-year project life. Notably, as there will be no haulage of ore off site, additional heavy vehicle movements as a result of the mine development will be minimal.

Based in the above, activities in the state forest are not anticipated to be impacted by the mine development.

8.4 Avoidance, management and mitigation

8.4.1 Mine design changes to avoid BSAL

A larger mining lease application area and disturbance footprint was originally identified for the mine development. However, some soil test pits in the far western portion of this area were identified as BSAL. The mine plan was consequently modified by reducing the proposed disturbance footprint to avoid impacting the identified areas of BSAL.

8.4.2 Management strategies

A comprehensive suite of management plans will be prepared and implemented for the mine development, subject to its positive determination. These management plans will be prepared in consultation with relevant government agencies and other stakeholders for the approval of the Secretary of DPIE in accordance with development consent conditions. Management plans of particular relevance to agriculture will include the Groundwater Management Plan, Surface Water Management Plan (including an Erosion and Sediment Control Plan), Rehabilitation Management Plan (which will include a Topsoil Management Plan), Pest and Weed Management Plan, and a Bushfire Management Plan.

Management plans will include monitoring programs and, where appropriate, establishment of triggers and their appropriate responses. In addition, rehabilitation criteria will be used as the basis for assessing when rehabilitation of the project is complete. The interim completion criteria have been developed and are presented in Chapter 22.

8.5 Conclusion

There is no BSAL located in the mining lease application area and proposed disturbance area associated with the mine development. A reduction in LSC classes 4 and 5 by 12 ha and 411 ha respectively, and an increase in LSC class 6 of 336 ha, class 7 of 17 ha and class 8 of 70 ha will occur as a result of the mine. Whilst some reduction in LSC class will occur, disturbed areas within the mine project area will be rehabilitated and returned to an agricultural land use, with the exception of the final void. The impacts to agricultural land within the project area will therefore predominantly be temporary.

The financial impact to the agricultural industry income of the disturbance footprint is calculated to be a reduction of $406,193/yr during the mine life and $95,373/yr upon rehabilitation, which equates to approximately 1% and 0.2% respectively, of the total $42.7M of income from agriculture within the Blayney LGA.

All mitigated risks on agricultural resources as a result of the mine development were assessed as low.


Chapter 9

Water resources



9 Water resources

9.1 Introduction

This chapter summarises the surface and groundwater assessments conducted for the mine development. The detailed Surface Water Assessment and Groundwater Assessment reports are provided in Appendix J and K, respectively.

This chapter describes the existing hydrological and hydrogeological environments and baseline conditions within the mine development and surrounding area and identifies the potential effects of the mine development on the existing water resources and sensitive receptors. Mitigation and management measures are also presented.

The assessments have been undertaken in accordance with the relevant EARs and additional agency requests. The water resources related EARs are presented in Table 9.1 and the additional agency requests are included in Appendix B.

Table 9.1 Water resources related EARs for the mine development

Requirement	Where addressed
– Assessment of the likely impacts of the development on the quantity and quality of surface, and groundwater, having regard to the *NSW Aquifer Interference Policy*	Section 9.5 Appendix J and Appendix K
– An assessment of the hydrological characteristics of the site and downstream	Section 9.2 and Appendix J
– An assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure and systems and other water users, including impacts to water supply from Carcoar Dam, riparian and licensed water users, use and discharge of water during construction, commissioning and maintenance of the pipeline infrastructure.	Section 9.5, Appendix J, Appendix K and Appendix X
– A detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply and transfer infrastructure and water storage structures and measures to minimise water use.	Section 9.4 and Appendix J
– Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP).	Section 9.3.1, Section 9.4.1, and Appendix J
– Description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo.	Section 9.6, Appendix J and Appendix K
– Detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts	Chapter 2, Section 9.2, Section 9.7, Appendix J and Appendix K
– A description of construction erosion and sediment controls, how the impacts of the development on areas of erosion, salinity or acid-sulphate risk, steep gradient land or erodible soils types would be managed and any contingency requirements to address residual impacts	Section 9.7, Appendix J
– An assessment of the potential flooding impacts of the project.	Section 9.5 and Appendix J
– Outcomes of the surface and groundwater assessments in relation to the likely final water level in the void. This should include an assessment of the potential for fill and spill along with measures required be implemented to minimise associated impacts to the environment and downstream water users.	Section 9.5, Appendix J and Appendix K
– Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential geochemical and bushfire risks, and storage, handling, transport and use of any dangerous goods.	Section 9.4, Section 9.5 (geochemical risks) and Appendix R

The surface water and groundwater assessments have been undertaken in consideration of the following Acts, regulations, methods and guidance documents:

- the *Water Management Act 2000;*
- the *Water Management (General) Regulation 2018*;
- the NSW AIP (DPI Water 2012);
- the WSP for the *Lachlan Unregulated and Alluvial Water Sources 2011*;
- the WSP for the *Belubula Regulated River Water Source 2012*;
- the WSP for the *New South Wales Murray-Darling Basin Fractured Rock Groundwater Sources 2011*;
- *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018);
- Risk assessment guidelines for groundwater dependent ecosystems (Serov et al 2012);
- NSW *Protection of the Environment Operations Act 1997*;
- *NSW State Groundwater Policy Framework Document* (DLWC 1997);
- *Flood Development Manual and Flood Prone Land Policy* (DIPNR 2005);
- National Water Commission *Australian Groundwater Modelling Guidelines* (Barnett et al 2012);
- Australian and New Zealand *Guidelines for Fresh and Marine Water Quality, Agriculture and Resource Management* Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council (ANZECC & ARMCANZ) 2000; and
- *Australian Drinking Water Guidelines* (NHMRC 2016).

9.2 Existing environment

The existing environment introduced in Chapter 5 is discussed in further detail with respect to water resources in this section.

9.2.1 Climate

The Blayney-Orange district is characterised by a mild temperate climate with warm to hot summers and cool to cold winters. Rainfall is typically highest during the winter months. Mean climatic data (rainfall and evaporation) shows that evaporation exceeds rainfall between January and April, and between September and December (Figure 9.1.). The long-term average annual rainfall for the area ranges from 710 mm (SILO) to 916 mm (Orange Agricultural Institute, BoM station 63254). SILO rainfall records have been compared to the nearly six years of site collected rainfall data and shows that the SILO data provides a valid representation of the climate in the project area (refer Appendix K for further discussion). As such, the SILO data (long-term average annual rainfall 710 mm) has been used in both the Surface Water and Groundwater Assessments.

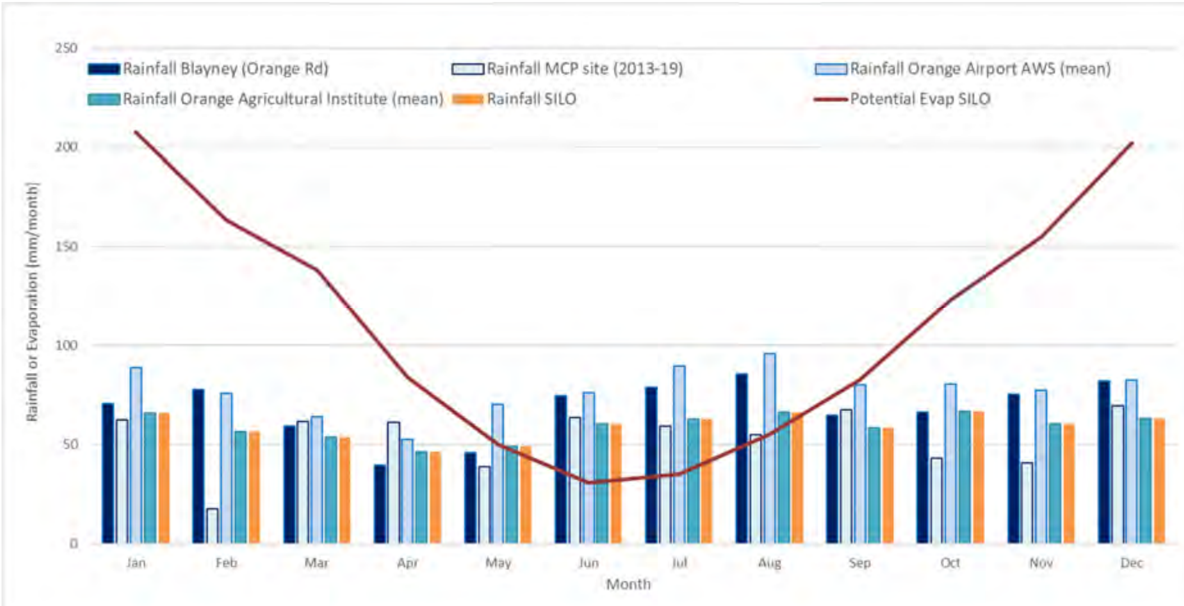


Figure 9.1 Mean climatic conditions

9.2.2 Surface water resources

i Catchment and flow description

The mine development is in the upper reaches of the Belubula River catchment, within the greater Lachlan River catchment. The Belubula River has its headwaters immediately north-east of the mine development and flows to the south-west into Carcoar Dam (approximately 26 km from the mine development). From Carcoar Dam, the Belubula River flows to the west, through Canowindra before merging with the Lachlan River between Cowra and Forbes. Figure 9.2 presents the regional hydrological features. As stated in the WSP for the *Lachlan Unregulated and Alluvial Water Source*, unregulated streams (like the Belubula River above Carcoar Dam) in western NSW experience long periods of no flow, interspersed with periods of varying magnitude.

A series of unnamed tributaries flow into the Belubula River in the mine project area and surrounding area. The upper reaches of the Belubula River are ephemeral with isolated, stagnant pools. For the purpose of the water assessment, the tributaries are referred to as Trib A to Trib K. The locations and catchment areas of these tributaries are shown in Figure 9.3. The combined catchment of Trib A-B is the most substantial of these tributaries, with a catchment area of approximately 24.4 km^2. By comparison, the Belubula River at the confluence with Trib A has a catchment area of approximately 17.5 km^2. As a result, the Trib A-B catchment contributes the majority of surface water flow to the Belubula River, more than the named Belubula River catchment itself. Downstream of the confluence with Trib A, the Belubula River appears to be a gaining system and is perennial (under typical climatic conditions).

Springs and seeps have been identified in the mine project area and most have been altered (excavated and converted into a dam) to allow cattle access for drinking water. Further discussion is provided in Section 9.2.4 and Appendix K.

ii Geomorphology

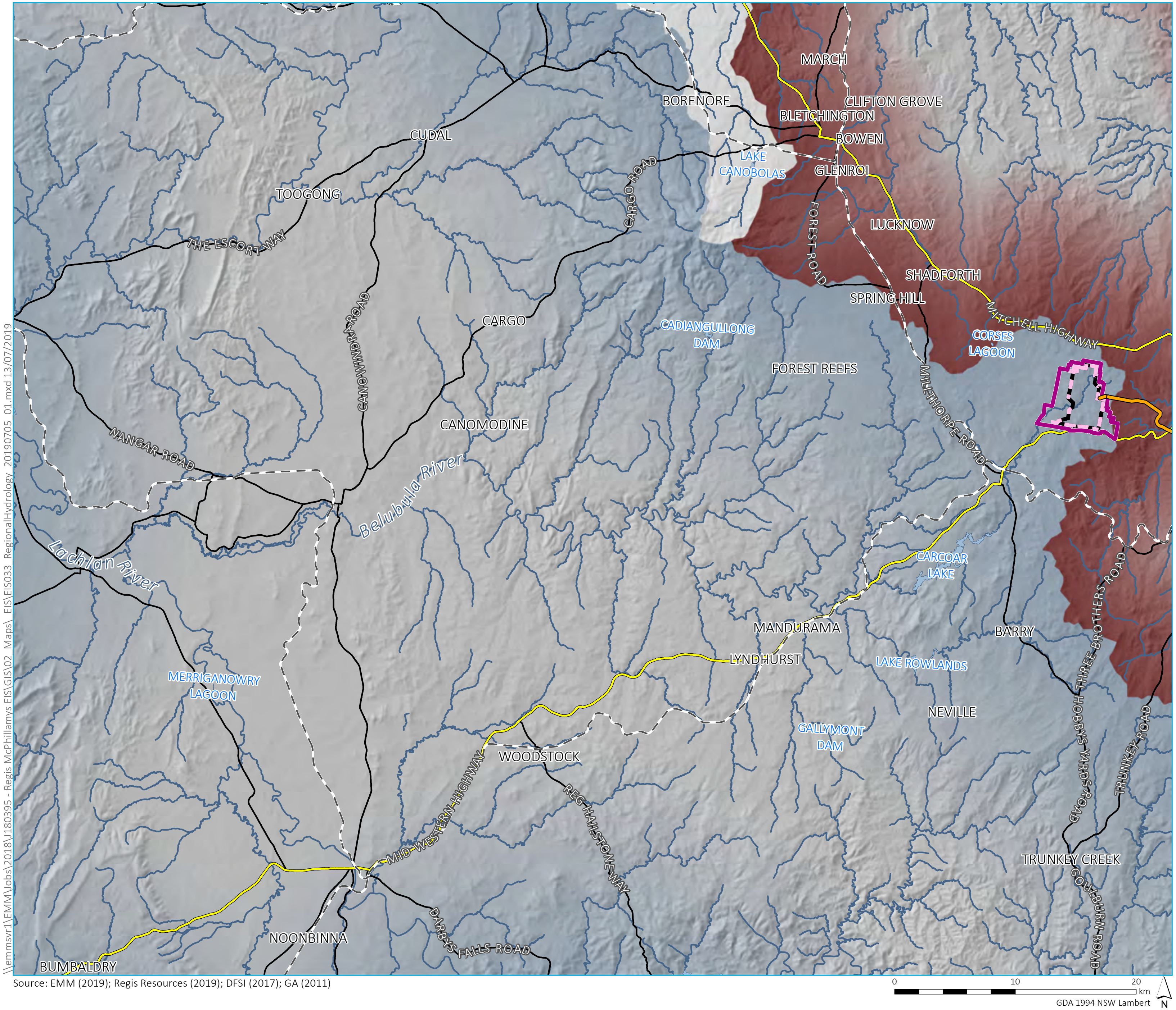
A stream geomorphological assessment was carried out to document the geomorphological characteristics and condition of the watercourses in the mine project area (Appendix J). The ground reconnaissance was conducted between 15 and 17 May 2017. The following points summarise the assessment outcomes.

- The Belubula River and its tributaries have been impacted by past land clearing, forestry activity, grazing, construction of on-stream farm storage dams and road crossings. The condition of the streams is highly variable over relatively short reaches, ranging from ill-defined shallow swales and drainage depressions to well-defined deeply incised channels with minor floodplain areas.

- The streams are noticeably degraded in some sections and are of higher quality in other less disturbed areas. The primary determinant of stream condition appears to be riparian vegetation. In many surveyed reaches, there is little tree cover in the riparian zone due to clearing of the land for grazing which has likely led to the existing degraded state of many of the surveyed reaches.

- Drainage of the highly modified agricultural land is characterised by topographical depressions providing drainage pathways comprising overland flows and ephemeral streams with only the downstream sections of the Belubula River as well as Trib A and Trib B exhibiting flow, pools or standing water between rainfall events.

Results of further assessments suggest that mapped streams in the upper reaches of the relevant catchment (above the proposed TSF location) cannot be properly characterised as first or higher order streams under the Strahler classification system (EMM 2018a). This is particularly true in the headwaters of the catchment and within the Vittoria State Forest. Many of the mapped streams in the catchment headwaters are simply depressions in the topography without incised channels, flow confinement or other attributes common to surface watercourses.



KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor

Existing environment

- Rail line
- Primary road
- Arterial road
- Named watercourse
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Catchment boundary

- Lachlan River
- Macquarie River

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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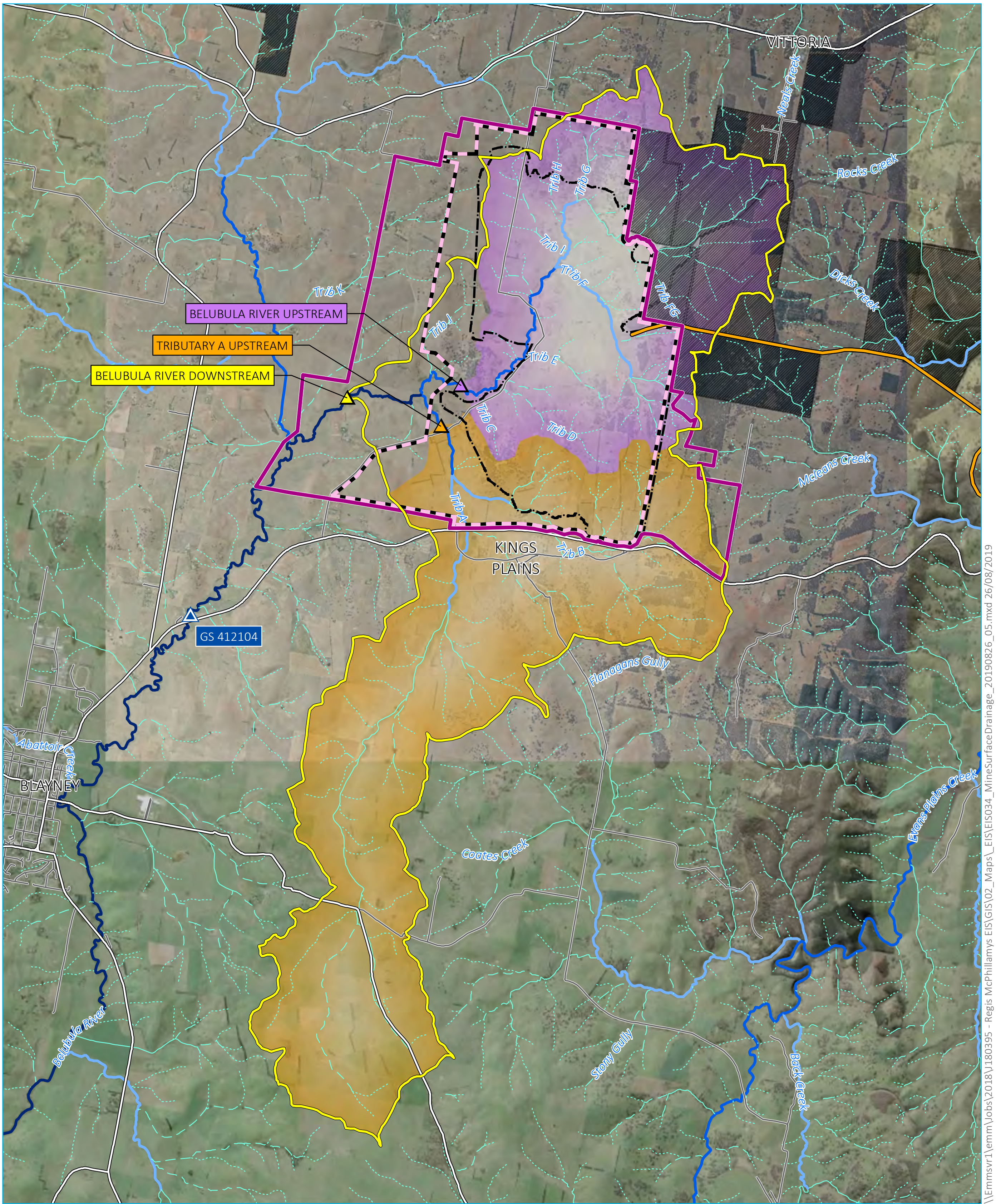
Regional hydrology

McPhillamys Gold Project
Environmental impact statement
Figure 9.2



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPI (2015); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vittoria State Forest

- Existing stream gauging station

Proposed stream gauging station
- Belubula River Downstream
- Belubula River Upstream
- Tributary A Upstream

Project catchment areas
- Area 1 (Belubula River Downstream) - 43.49 km²
- Area 2 (Belubula River Upstream) - 16.15 km²
- Area 3 (Trib A Upstream) - 24.52 km²

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Project area surface drainage

McPhillamys Gold Project
Environmental impact statement
Figure 9.3

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iii Existing surface water use entitlements

The mine development is in the unregulated surface water source of the Belubula River above Carcoar Dam, managed under the WSP for the *Lachlan Unregulated and Alluvial Water Sources 2011*. Further downstream, the Belubula River is managed under the WSP for the *Belubula Regulated River Water Source 2012*. All water take that is not for basic landholder rights or exempt from requiring a licence must be authorised by a WAL under the WM Act.

The NSW Water Register identifies three active, unregulated river WALs (totalling an entitlement of 264 ML) for the Belubula River above Carcoar Dam Water Source. Within the regulated Belubula River water source, there are 117 WALs with a total entitlement of 26,883 share components (ML).

Under the WM Act, landholders in most rural areas are permitted to collect a proportion of rainfall runoff on their property and store this runoff in one or more dams up to a certain size. This is known as "harvestable rights". A dam (or series of dams) can capture up to 10% of the average regional rainfall runoff for their landholding without requiring a licence.

The total harvestable right for the land held by Regis (2,907 ha) has been calculated at 218 ML. This equates to a yield rate of 0.075 ML/ha per year (ie 218 ML = 10% x 0.75 ML/ha x 2,907 ha). The estimated total capacity of existing farm dams on Regis landholdings that are outside the disturbance area, and will remain in place, is approximately 73 ML. Therefore, the remaining harvestable right, subtracting the existing farm dam capacity, is 145 ML.

iv Surface water monitoring

The existing surface water monitoring network for the project is shown on Figure 9.4 and is described in the following sections.

a Streamflow

The closest gauging station to the mine development is the disused gauging station 412104, located near the Mid Western Highway and has a catchment area of 111 km^2 (Figure 9.3). The period of record for this station was 1993 to 1997. Available flow data suggests that this gauging station (412104) was effectively perennial for the four years of recorded data, with periods of no flow only recorded approximately 1% of days of the record (Appendix J).

Stream gauging stations are also located downstream of the project, including at and upstream of the Carcoar Dam (Appendix J). Three additional flow monitoring stations (v-notch weirs) will be constructed within the mine development area at locations shown in Figure 9.3 on the:

- Belubula River downstream of the confluence with Trib A (Area 1 shown on Figure 9.3). This flow monitoring station will measure surface flows within the Belubula River, including Trib A to Trib J, and will provide data to observe the changes in flows as a result of the mine development;

- Belubula River upstream of the confluence with Trib A (Area 2 shown on Figure 9.3). This station will measure surface flows within the Belubula River upstream of Trib A, including water flows from Trib C to Trib I; and

- Trib A upstream of the confluence with the Belubula River (Area 3 shown on Figure 9.3). This station will measure surface flows within Trib A-B.

Monitoring flow in the local creeks prior to development of the project, especially low flows, is an important component for measuring potential impacts from the project. Regis is seeking approval for the Belubula River flow monitoring stations.

A GoldSim water balance model was developed for the Carcoar Dam catchment, as part of the Surface Water Assessment (Appendix J), to estimate existing flow conditions and assess the potential effects of the project on inflows to Carcoar Dam. Table 9.2 presents the modelled streamflow at Carcoar Dam, the Mid Western Highway (gauging station 412104) and the proposed downstream gauging station (Figure 9.3). Table 9.2 shows that the estimated median annual flow to Carcoar Dam is 5,836 ML/yr or higher and that 95% of the time, flows are 1,463 ML/yr or higher.

Table 9.2 Modelled streamflow – existing conditions

Percentage of time flow is greater than the modelled inflow	Carcoar Dam (ML/yr)	Mid Western Highway (GS 412104) (ML/yr)	Proposed downstream gauging station (ML/yr)
95%	1,463	697	273
90%	1,941	924	362
50%	5,836	2,792	1,093

Notes: Refer Appendix J for further details

b Surface water quality

Surface water samples have been periodically collected from the Belubula River, select dams and spring / seep locations identified in and downstream of the mine development area since 2014 (Figure 9.4). There are three monitoring locations downstream of the mine development which have been selected to assess the existing surface water quality at different locations along the Belubula River:

- WED9913A - Belubula River upstream of Blayney township;
- WED7396A - Belubula River at Goose Park in Blayney township, downstream of the confluence with Abattoir Creek; and
- WED5401A - Belubula River downstream of Blayney township at Brewery Bridge.

The number of baseline sampling events at surface water monitoring locations (up to March 2019) is provided in Table 9.3. Seven new monitoring locations were added to the sampling program in March 2019, including the three sites listed above, in order to collate information to contribute to the conceptual hydrological and hydrogeological understanding of the area. Baseline monitoring will continue in the area, and monitoring sites will be updated as further information is gathered.

Table 9.3 Existing surface water quality monitoring locations

Site ID	Site type	Earliest sample collection	Most recent sample collection	Number of sampling events
WED1276A	Dam	Jun-14	Mar-19	27
WED1825A	Watercourse	May-14	Mar-19	26
WED2344A	Dam	May-14	Mar-19	32
WED2726A	Watercourse	Mar-19	Mar-19	1
WED2847A	Dam	May-14	Mar-19	31
WED2935A	Watercourse	May-14	Mar-19	29

Table 9.3 Existing surface water quality monitoring locations

Site ID	Site type	Earliest sample collection	Most recent sample collection	Number of sampling events
WED3052A	Dam	May-14	Mar-19	27
WED3275A	Dam	Jun-14	Mar-19	28
WED3466A	Watercourse	Jul-17	Mar-19	15
WED3662A	Dam	Aug-14	May-17	14
WED4061A	Watercourse	Jun-14	Dec-18	23
WED4775A	Dam	May-14	Mar-19	25
WED5401A	Watercourse	Mar-19	Mar-19	1
WED6647A	Dam	Mar-19	Mar-19	1
WED7396A	Watercourse	Mar-19	Mar-19	1
WED9913A	Watercourse	Mar-19	Mar-19	1
WES1164A	Spring	Jul-17	Dec-18	11
WES4660A	Spring	Mar-19	Mar-19	1
WES4865A	Spring	Mar-19	Mar-19	1
WES5669A	Spring	Jul-17	Mar-19	16
WES7729A	Spring	Sep-17	Mar-19	14

Surface water quality monitoring includes the following physico-chemical parameters and analytes:

- field measured pH, electrical conductivity (EC), temperature;
- major ions; and
- metals, nutrients and hydrocarbons.

Surface water quality results have been compared to the ANZECC (2000) 80% protection level of freshwater aquatic ecosystems, which the NSW government has adopted as the Water Quality Objectives (WQOs) for this area. The ANZECC (2000) guideline provide recommended concentration limits for water salinity, pH, nutrients, metals and other analytes that can affect freshwater aquatic ecosystems. Summary statistics for recorded pH, EC and other parameters for surface water monitoring locations are provided in Appendix J.

Salinity (as field measured electrical conductivity, EC) for all surface water monitoring sites is fresh and ranges from 47 to 1,650 µS/cm. The following provides a summary of the surface water monitoring salinity observations:

- salinity (EC) of dam monitoring sites ranges from 47 to 1,550 µS/cm;
- Belubula River watercourse monitoring sites has had EC range from 400 to 1,650 µS/cm;
- the Belubula River gets gradually fresher (lower salinity) further downstream from the mine development, likely due to the increasing catchment area and contribution of water from increasing number of tributaries;

- spring /seep water salinity (EC) ranges from 80 to 1,454 µS/cm.

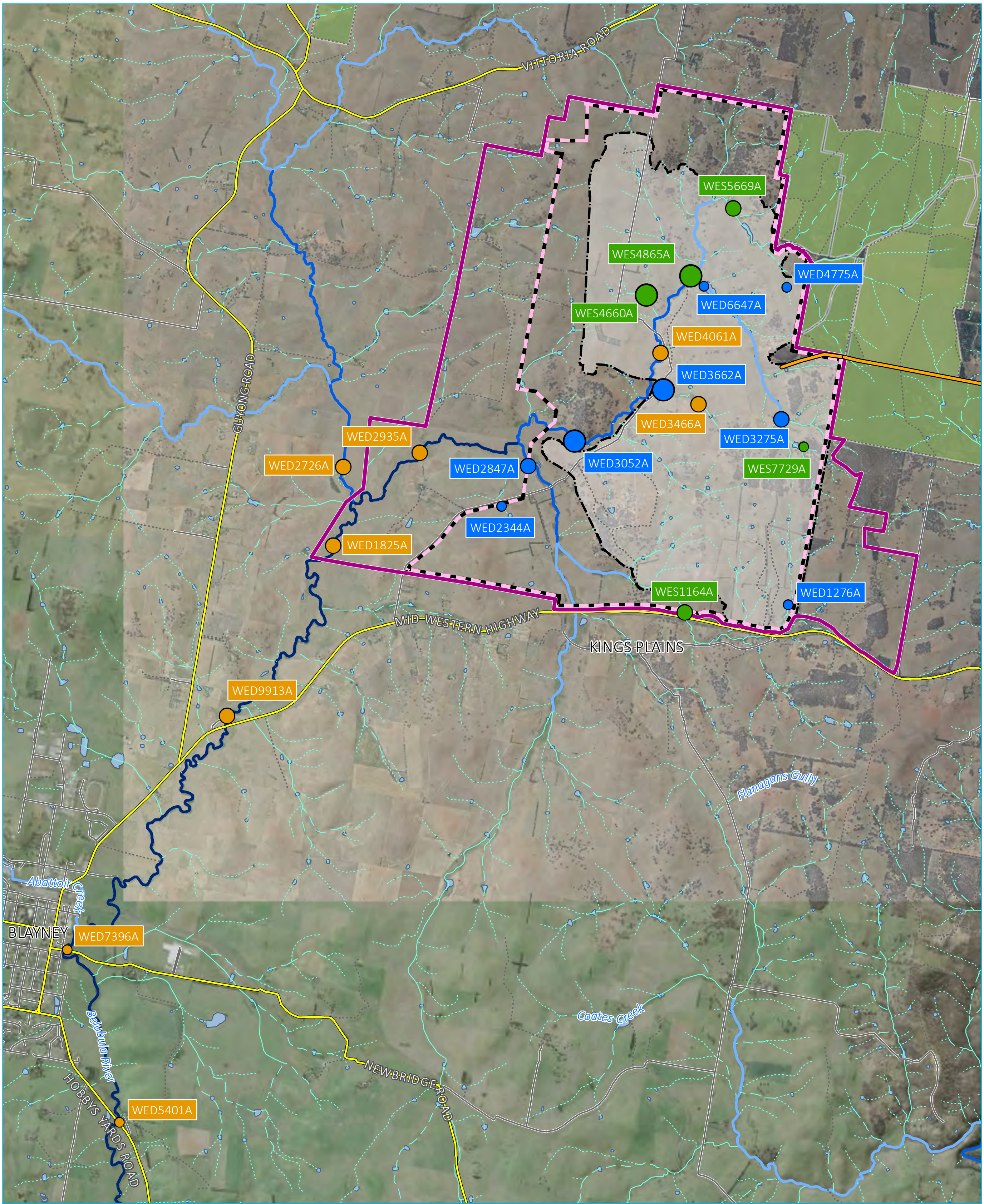
Figure 9.4 also presents the spatial distribution of surface water salinity (as median EC).

The following is a summary of the WQO exceedances:

- the WQO for EC was exceeded in the majority of samples collected, with the exception of two monitoring sites WED5401A (downstream of Blayney) and WED1276A (dam in the south-east corner of the mine development);
- there have been no exceedances of the WQO for sulphate (SO_4), arsenic (As), cadmium (Cd) or cyanide (CN) recorded at any surface water monitoring location;
- the WQO for zinc was exceeded in some samples collected at WED2344A, WED3466A, WED4775A and WES7729A;
- total nitrogen and total phosphorus WQOs were exceeded in the majority of samples from all sites.

The baseline water chemistry suggests that the ANZECC (2000) guidelines are not representative of the background conditions in the project area and site specific WQOs should be developed prior to project commencement using all available baseline data (as part of the Water Management Plan for the project, if approved). Exceedances of the ANZECC (2000) guideline values can be as a result of natural catchment conditions and/or land use modification.

Water quality of dams and springs is discussed in Appendix K.



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPE (2015); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vehicular track
- Vittoria State Forest

Waterbody

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Surface water monitoring site
- Dam
- Spring
- Watercourse

Median salinity (EC µS/cm)
- 165 - 500
- 501 - 1000
- 1001 - 1430

Surface water monitoring locations and salinity plan

McPhillamys Gold Project
Environmental impact statement
Figure 9.4

9.2.3 Groundwater resources

i Geology

The geology in and around the mine development area is characterised by the Palaeozoic metamorphic rocks of the eastern Lachlan Fold Belt (LFB). The LFB is dominated by Ordovician Devonian volcaniclastics and marine sediments (French et al 2013). Within the mine development area, the lithological sequence reduces in age to the east, with Ordovician carbonates and mafic volcanics in the west and argillaceous Devonian sediments in the east (French et al 2013).

Basalt caps, such as the basalt present around Orange to the north-west of the project area, occur in the regional area. There are no large deposits of basalt within the project area.

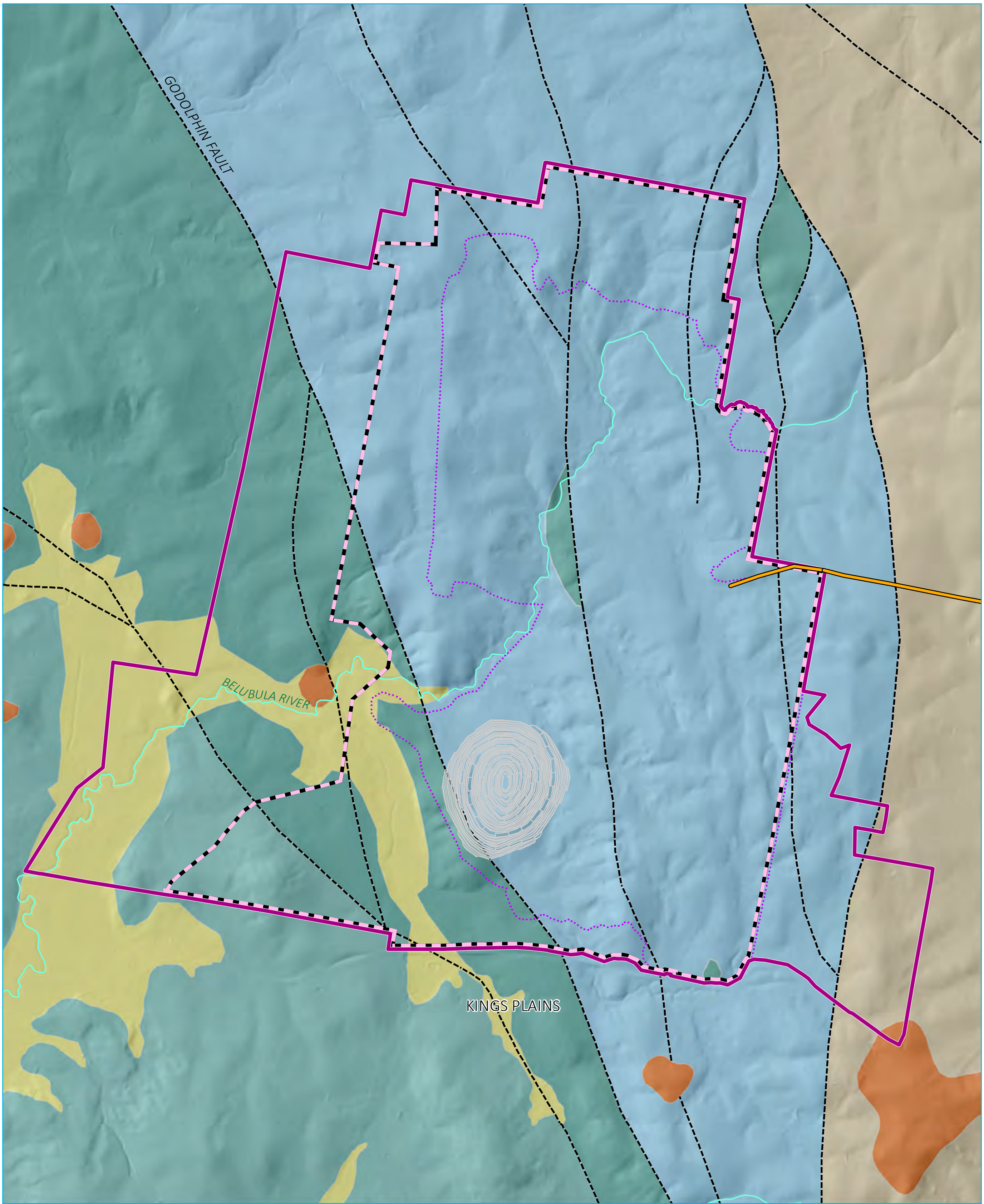
The McPhillamys gold deposit is associated with the Sherlock Fault, part of the Godolphin-Copperhania thrust fault zone (Figure 9.5).

The local stratigraphy is presented in Table 9.4 and shown in Figure 9.5

Table 9.4 Project area stratigraphy

Age	Group	Formation	Description
Quaternary	-	Alluvium	Disconnected alluvial sediments deposited by surface watercourses.
Tertiary	Canobolas Volcanic Complex	Basalt	Pyroxene olivine basalt, plagioclase basalt, alkali basalt, trachybasalt, trachyandesite. Succession of basalts flows generally 2-60 m thick (up to 150 m).
Devonian	-	Cunningham	Phyllite, slate, shale, siltstone, quartz-feldspar-lithic- calcareous sandstone, tuff
Silurian	Mumbil Group	Anson Formation	Metasediments and volcaniclastics separated by north-south trending faults. Carbonaceous pyritic siltstone, felsic volcanics, volcanic sandstone, limestone.
Ordovician	Cabonne Group	Blayney Volcanics	Clinopyroxene basalt, agglomeratic in places; volcanic sandstone. Dominated by volcaniclastic rocks of andesitic composition.
		Byng Volcanics	Basalt, volcaniclastic sandstone. Dominated by volcaniclastic rocks of andesitic composition.

Notes: Australian Stratigraphic Units Database (Geoscience Australia 1997)



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

KEY

Named watercourse

Geology (Bathurst 250k, 2nd Edition)

Fault

Quaternary / Tertiary

Alluvium

Tertiary basalt

Devonian

Ungrouped Devonian Formations - Cunningham Formation

Silurian

Mumbil Group (Northwest) - Anson Formation

Ordovician

Cabonne Group - Blayney Volcanics

Cabonne Group - Byng Volcanics

Project application area

Mine development project area (2,513.47 ha)

Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Disturbance footprint

Open cut mine

Pipeline corridor

Local and structural geology - mine project area

McPhillamys Gold Project
Environmental impact statement
Figure 9.5

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ii Regional hydrogeology

The hydrogeology surrounding the project is dominated by the Palaeozoic metamorphic rocks of the eastern LFB. The dominant structure influencing groundwater flow is the Godolphin-Copperhania Fault Zone (Figure 9.5).

The groundwater system is recharged locally by the percolation of rainfall and leakage from surface watercourses. Groundwater discharge occurs via evapotranspiration, spring flow, and contributions to surface watercourses (baseflow). Alluvial deposits along the creek banks and drainage lines provide temporary groundwater storage following rainfall and a delayed source of baseflow.

The closest most productive groundwater source to the project is the Orange Basalt which outcrops approximately 4 km north-west of the mine development and provides water supply for irrigators, industry and domestic purposes.

iii Hydrostratigraphy

Five key hydrostratigraphic units (HSUs; units that act as aquifers or aquitards) have been identified in the mine development and surrounding area.

- HSU 1 – shallow, disconnected alluvial sequences. These unconfined, typically perched, aquifers are likely recharged by the infiltration of rainfall and surface flows. The aquifers are inferred to provide a source of delayed flow to the Belubula River and major tributaries, however, rapidly deplete between recharge events.

- HSU 2 – chemically weathered metasediments and volcaniclastics sediments collectively referred to as 'saprock.' These weathered rocks act as low permeability aquifers and are recharged via the infiltration of rainfall and overland flow. The saprock is comprised of fine-grained clay with limited permeability.

- HSU 3 – the Byng and Blayney Volcanics. These volcanics are comprised of fine siltstones and sandstones with low primary porosity and permeability. Groundwater flow is predominantly via secondary porosity (faulting and joints) and geological contacts. Bore yields are relatively low and the unit generally acts as a confining unit rather than an aquifer. Recharge to the fractured rock is via rainfall in areas of outcrop and vertical leakage from overlying saprock or alluvial sediments (where present).

- HSU 4 – the Silurian Anson Formation and Devonian Cunningham Formation. The Anson Formation underlies the mine development area and has low primary porosity and permeability. Groundwater flow is primarily along fault zones. Recorded bore yields are typically low (< 5 litres per second (L/sec)). Recharge is via rainfall in areas of outcrop and vertical leakage.

- HSU 5 – the Orange Basalt, a well-developed aquifer system to the north-west of the mine development. The Orange Basalt is a productive aquifer accessed for town water supply, industry and domestic purposes. Groundwater is accessed from relatively shallow (<100 m) basalt flows. This unit is outside of the area of influence of the proposed McPhillamys project (refer Appendix K).

iv Existing groundwater use entitlements

The mine development is within the LFB Murray Daring Basin (MDB) Groundwater Source. Groundwater in this source is managed by the WSP for the *NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2011*. There are currently 1,067 WALs available, with a total entitlement of 70,051 share components (ML) in the LFB MDB Groundwater Source.

The groundwater source is generally not highly productive and groundwater abstraction within the Silurian and Ordovician formations is generally for stock and domestic purposes.

The Newcrest Mining Limited (Newcrest) Cadia Valley Operations (Cadia) is located 25 km west of the mine development and forms the largest groundwater user from this source in the vicinity.

v Groundwater monitoring network

Routine water monitoring commenced at the project in May 2014 across a network of landholder bores and surface water features. Up to five years of baseline hydrogeological data has been collected across the project site.

A project specific groundwater monitoring network has been installed in the mine development area and comprises 23 monitoring points, distributed across 14 locations (Figure 9.6). Over two years of continuous groundwater level data and water quality data has been collected across the network.

vi Hydraulic properties

The understanding of local and regional hydrogeology is enhanced by reported observations at Cadia. Reported values of horizontal hydraulic conductivity from Cadia range from 4×10^{-7} to 1.2×10^{-3} m/day (1.5×10^{-4} to 0.4 m/year) for Ordovician volcanics and 3.8×10^{-2} m/day (14 m/year) for the Silurian metasediments (AGE 2009).

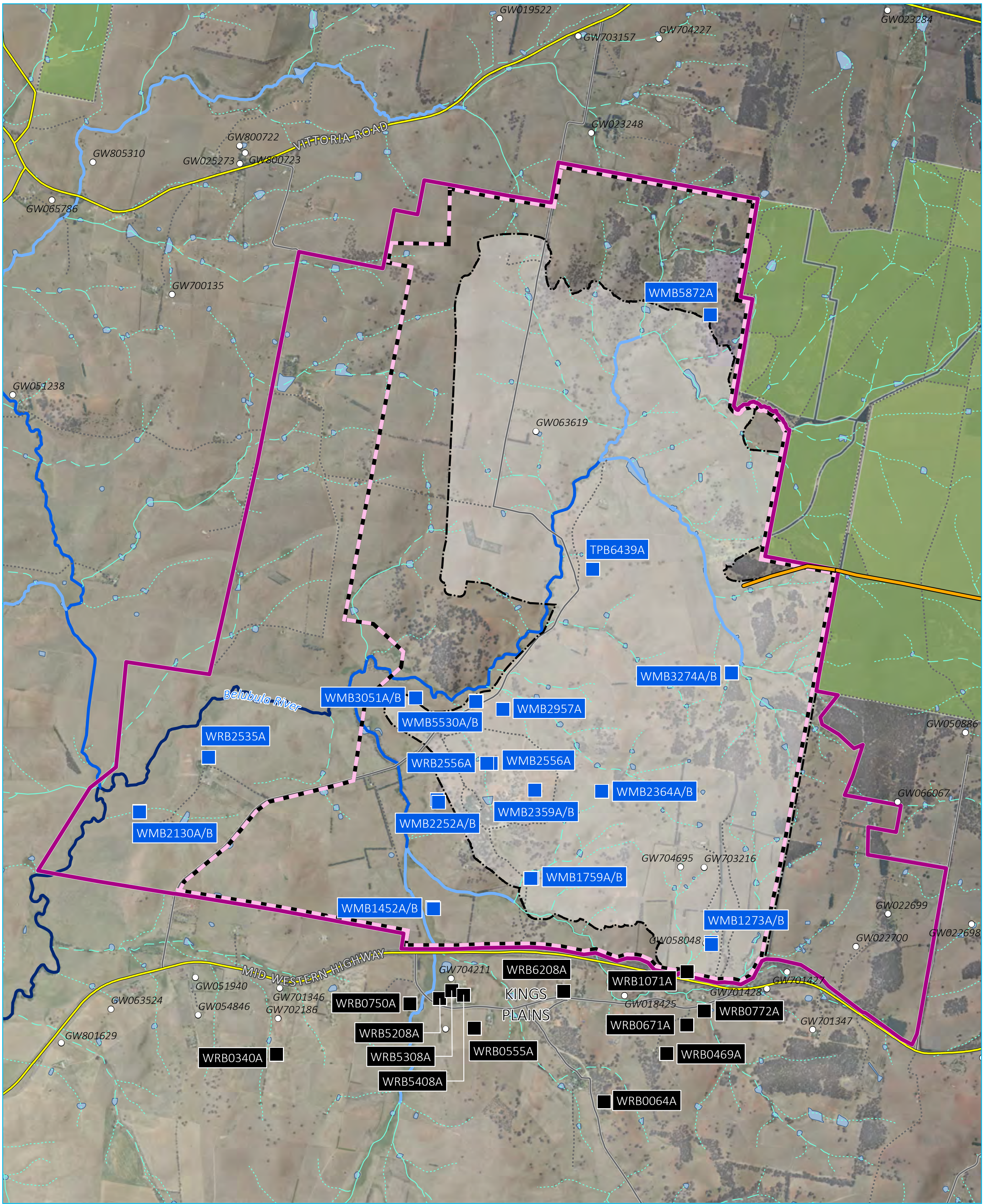
Reported groundwater yields from registered bores within 10 km of the mine development range from <0.5 L/sec to 9 L/sec (Figure 9.7) (WaterNSW 2019b).

A range of hydraulic tests have been conducted to provide site-specific information on the hydraulic properties of the identified HSUs, including the carbonaceous alteration that is present within the open cut mine area. Tests completed include rising and falling head tests (slug tests), laboratory core permeability tests and airlift recovery tests. Locations and details of hydraulic test results can be found in Appendix K. Table 9.5 summarises the range in measured and literature sourced hydraulic conductivity for the geological units in the area.

Due to the low yielding nature of the geology in the mine development area, it has not been practical to conduct a pumping test program, which would allow estimates of aquifer storage and additional hydraulic conductivity data.

Table 9.5 Summary of hydraulic conductivity data

Geological unit	Hydraulic conductivity (m/day)	Literature range
	Measured range	
Alluvium	0.1	-
Carbonaceous alteration	5×10^{-3} to 0.3	-
Anson Formation (saprock)	8.6×10^{-8} to 1.3	3.8×10^{-2}
Anson Formation	9.2×10^{-8} to 0.5	
Byng Volcanics (saprock)	0.1 to 0.2	4×10^{-7} to 1.2×10^{-3}
Byng Volcanics	2×10^{-4} to 0.5	
Blayney Volcanics	0.4	
Basalt	-	2.2×10^{-1}



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPI (2016); DPE (2015); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

N

KEY

Project application area

Mine development project area (2,513.47 ha)

Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Disturbance footprint

Pipeline corridor

Groundwater monitoring site - Regis

Groundwater monitoring site - other landholder

Registered bore - not monitored

Existing environment

Main road

Local road

Vehicular track

State forest

Waterbody

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

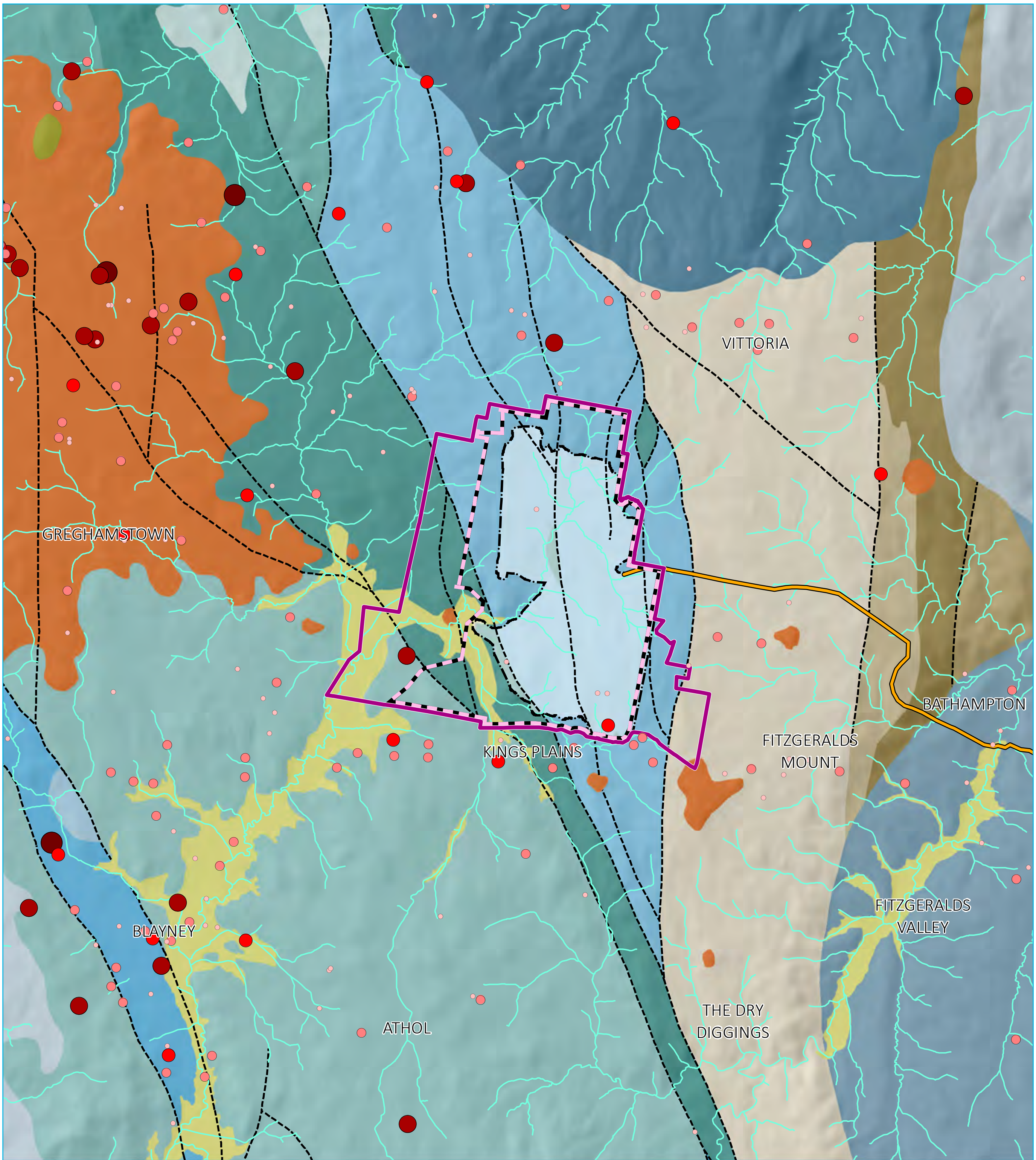
6th order

Groundwater monitoring network

McPhillamys Gold Project

Environmental impact statement

Figure 9.6



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015, 2003); GA (2011)

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KEY

Watercourse/drainage line

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Geology (Bathurst 250k, 2nd Edition)
- Fault

Quaternary / Tertiary
- Alluvium
- Tertiary basalt
- Trachyte

Carboniferous
- Bathurst Batholith - Dunkeld Granite
- Bathurst Batholith - Gresham Granite
- Bathurst Batholith - Icely Granite

Devonian
- Ungrouped Devonian Formations - Cunningham Formation
- Crudine Group - Bushranger Volcanics
- Crudine Group - Turondale Formation
- Crudine Group - Waterbeach Formation

Silurian
- Other Silurian Intrusions - Carcoar Granodiorite
- Other Silurian Intrusions
- Mumbil Group (Northwest) - Anson Formation
- Mumbil Group (Northwest) - Wombiana Formation
- Mumbil Group (East) - Campbells Formation

Ordovician
- Ordovician Intrusions
- Cabonne Group - Blayney Volcanics
- Cabonne Group - Oakdale Formation
- Cabonne Group - Byng Volcanics

Registered bore - yield (L/s)
- 0.0 - 0.5
- 0.5 - 2.0
- 2.0 - 3.0
- 3.0 - 5.0
- 5.0 - 8.8

Registered bore yield map

McPhillamys Gold Project
Environmental impact statement
Figure 9.7

vii Groundwater levels and flow

The regional groundwater flow direction is generally towards the south-west, towards the Belubula River. Figure 9.8 presents the elevation of the watertable in the project area. The watertable is a subdued reflection of topography, generally within 10-15 m of the ground surface.

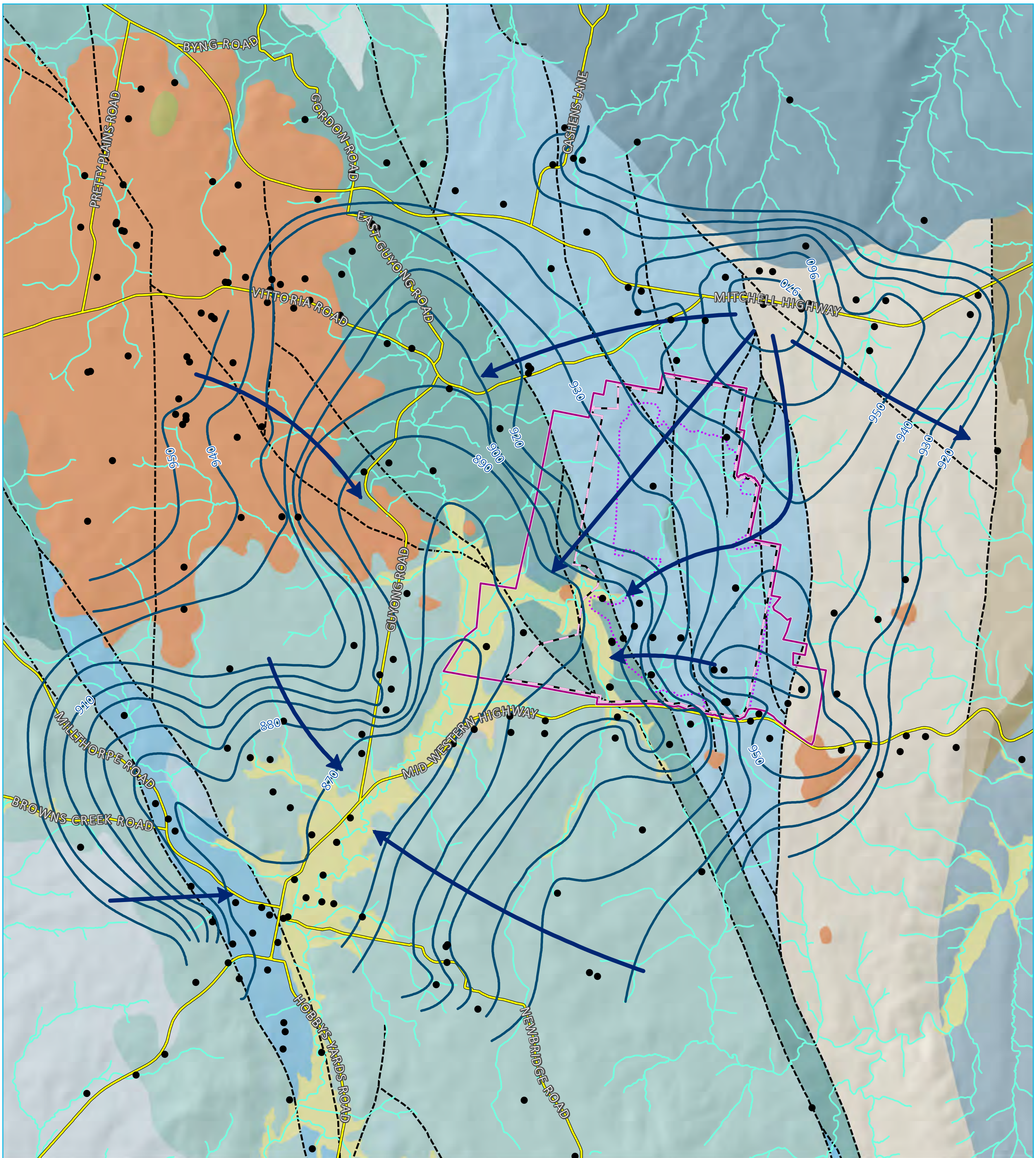
Local groundwater flow is influenced by the steep topography in the mine development area. Groundwater generally flows from areas of higher elevation to incised areas around the Belubula River and major tributaries. The groundwater level varies with topography and ranges from 860 to 975 mAHD. Figure 9.8 shows that groundwater is inferred to locally discharge to the Belubula River downstream of Trib A.

The Anson Formation, Blayney Volcanics and Ordovician Volcanics are separated by major faults which can form barriers to groundwater flow or act as transmissive conduits. Groundwater flow across the study area is impeded by the Godolphin fault as evidenced by groundwater level measurements and the formation of ephemeral springs along the contact (Appendix K).

Seasonal trends are obtained by observing groundwater levels over time; this can also provide opportunity to assess long-term increases or decreases to the groundwater resource. Hydrographs of groundwater level baseline data are included in Appendix K. The data shows the groundwater level has been gradually declining during the baseline monitoring period at most groundwater monitoring bores. This correlates with below average rainfall observed from 2012-2016 and 2017-2019. Seasonal trends are not evident at most groundwater monitoring sites during the baseline monitoring period.

Vertical gradients are analysed for potential movement of groundwater between HSUs. Groundwater monitoring data indicates a general downward vertical gradient, with groundwater within the upper weathered units recharging the underlying fractured rock system. At some sites the vertical gradient is negligible suggesting minimal groundwater leakage (predominantly horizontal flow).

However, at paired monitoring site WMB1273A/B located in the south eastern corner of the mine development area, the shallower monitoring bore (WMB1273B installed in the Anson Formation saprock) has a lower hydraulic head than the deeper monitoring bore (fresh Anson Formation) indicating upward leakage to the saprock at this location and potentially to surface water in the area.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015, 2003); GA (2011)

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KEY

- Regional bore
- Watertable elevation (mAHD) (inferred)
- Groundwater flow direction
- Main road
- Watercourse/drainage line

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint

Geology (Bathurst 250k, 2nd Edition)

- Fault

Quaternary / Tertiary

- Alluvium
- Tertiary basalt
- Trachyte

Carboniferous

- Bathurst Batholith - Gresham Granite
- Bathurst Batholith - Icely Granite

Devonian

- Ungrouped Devonian Formations - Cunningham Formation
- Crudine Group - Bushranger Volcanics
- Crudine Group - Waterbeach Formation

Silurian

- Other Silurian Intrusions - Carcoar Granodiorite
- Other Silurian Intrusions
- Mumbil Group (Northwest) - Anson Formation
- Mumbil Group (Northwest) - Wombiana Formation
- Mumbil Group (East) - Campbells Formation

Ordovician

- Ordovician Intrusions
- Cabonne Group - Blayney Volcanics
- Cabonne Group - Oakdale Formation
- Cabonne Group - Byng Volcanics

Inferred watertable elevation and groundwater flow direction

McPhillamys Gold Project
Environmental impact statement
Figure 9.8

viii Groundwater recharge and discharge

Recharge to the aquifer systems is expected to occur primarily via rainfall infiltration. There will also be some recharge from the streams at times of high streamflow and flooding. Rainfall recharge for the project was assessed via a literature review and the chloride mass balance method (Scanlon et al 2002). Results are documented in Appendix K. In summary, the recharge rates for the identified HSUs are assessed to be:

- alluvium: 8% of annual rainfall;
- Anson Formation saprock: 2 to 4% of annual rainfall;
- Ordovician volcanics and saprock: 1 to 5% of annual rainfall; and
- Orange Basalt: 4 to 6% of annual rainfall.

Groundwater discharge occurs to the Belubula River, predominantly in areas downstream of the mine development.

ix Groundwater quality

Regional groundwater salinity measured at third party bores within 10 km of the project were sourced from the Australian Groundwater Explorer (BoM 2019). Salinity is generally fresh and suitable for livestock watering (ANZECC 2000 and DPI 2014).

Regis has collected groundwater samples for laboratory water quality analysis across the project area since May 2014; many bores with more than 20 sampling events (up until March 2019). This data provides the basis for understanding the pre-mine baseline groundwater resource condition. Results and analysis are summarised in Appendix K.

For reference, groundwater chemistry laboratory data are compared against:

- the Australian and New Zealand (ANZECC) Guidelines that are relevant to the protection of freshwater aquatic ecosystems, irrigation and stock drinking water;
- NSW Department of Primary Industries (2014a) Water requirements for sheep and cattle; and
- the Australian Drinking Water Guidelines (NHMRC 2016).

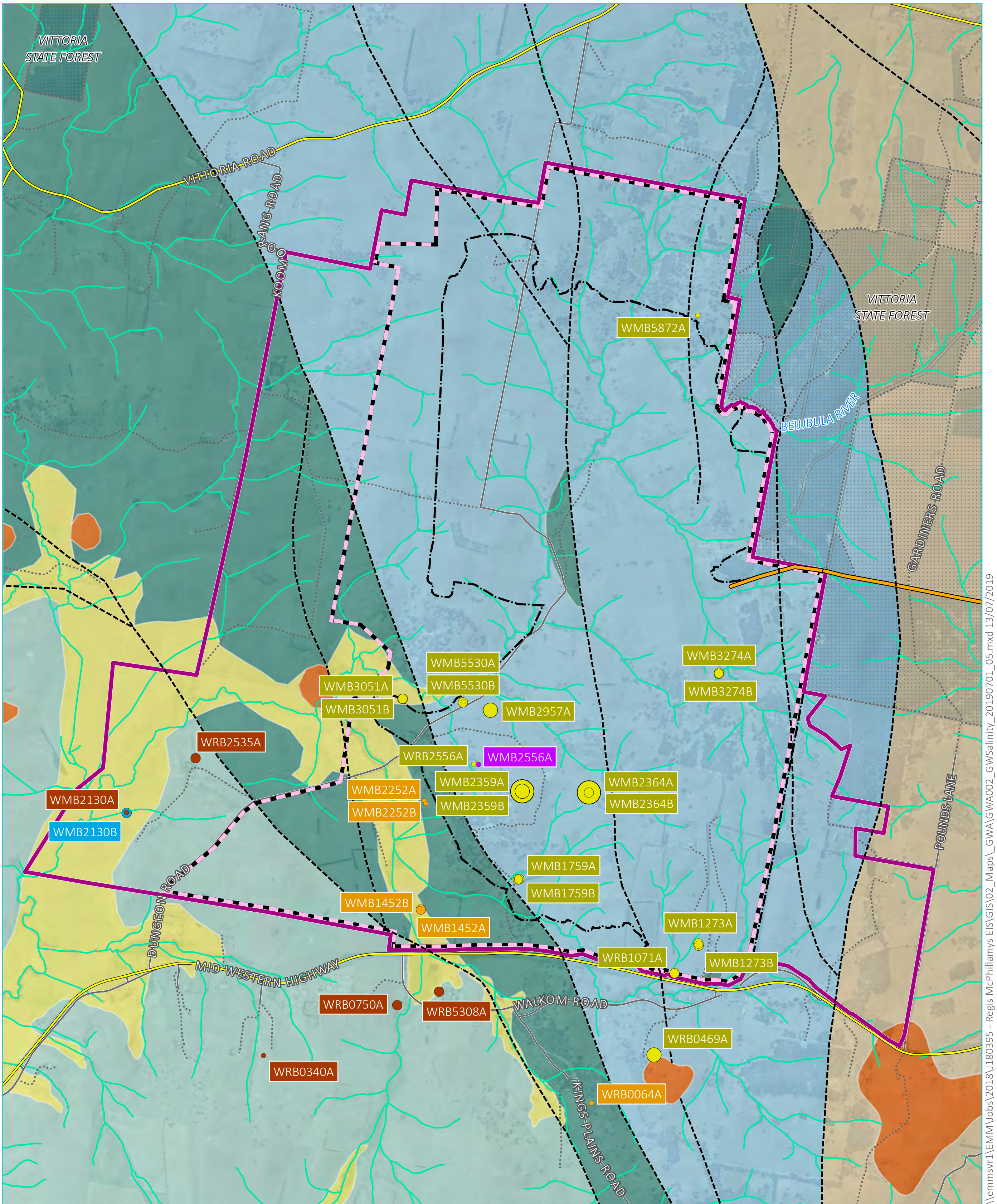
The above guidelines provide recommended concentration limits for water salinity, pH, nutrients, metals and other water quality parameters.

Figure 9.9 presents the spatial distribution of groundwater salinity (as median TDS). Groundwater quality is fresh to brackish and varies depending on the geology. Groundwater in the Anson Formation has the highest salinity (up to 4,817 µS/cm EC). Groundwater pH generally varies from slightly acidic to slightly alkaline, however some pH measurements from monitoring bores have been as low as 2.2 (Anson Formation).

Groundwater samples collected during the baseline monitoring period have also been analysed for dissolved metals, nutrients and hydrocarbons. Data and more detailed discussion is provided in Appendix K.

Dissolved metals are naturally high at some locations, including copper, aluminium, cadmium, manganese, nickel, fluoride, zinc. Some bores installed within the volcanics have arsenic concentrations reported above the ANZECC (2000) livestock drinking water guideline value. Laboratory reported water quality indicates that groundwater is generally suitable for livestock water, except for some water quality parameters (including salinity and pH) at some locations.

The available water quality monitoring data results suggest that the ANZECC (2000) guidelines are not representative of the baseline conditions in the project area and site specific WQOs and triggers should be developed prior to project commencement using all available baseline data (as part of the Water Management Plan for the Project, following approval).



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPE (2015); ELVIS (2014); DPE (2003)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- State forest

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

- Fault (250k)

Geology (Bathurst 250k, 2nd Edition)

Quaternary / Tertiary
- Alluvium
- Tertiary basalt

Devonian
- Ungrouped Devonian Formations - Cunningham Formation

Silurian
- Mumbil Group (Northwest) - Anson Formation

Ordovician
- Cabonne Group - Blayney Volcanics
- Cabonne Group - Byng Volcanics

Groundwater salinity

Aquifer
- Anson Formation
- Blayney Volcanics
- Byng Volcanics
- Alluvium
- Marble

Median TDS (mg/L)
- 83 - 500
- 500 - 1000
- 1000 - 2000
- 2000 - 3000
- 3000 - 4405

Project area salinity plan

McPhillamys Gold Project
Environmental impact statement
Figure 9.9

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9.2.4 Groundwater - surface water interaction

Groundwater discharge to watercourses is inferred to be confined to isolated areas associated with alluvium or geological structures. The overall contribution from groundwater to the Belubula River upstream of Trib A is inferred to be minor. Field observations suggest that the upper reaches of the Belubula River are ephemeral and losing streams, with the depth to watertable below the base of the creek. Groundwater is predicted to currently contribute approximately 5% of overall surface flows in Trib A and the Belubula River upstream of Trib A (during average climate conditions). In the lower reaches of the Belubula River, below the main project infrastructure and confluence with Trib A, the watercourse is perennial, and groundwater is inferred to discharge in this area. In this area, groundwater is predicted to currently contribute approximately 5-10% of surface flows during average climatic conditions, and up to 40% of surface flows during lower rainfall periods. As shown on Figure 9.8, groundwater is inferred to discharge locally to the Belubula River downstream of Trib A (from the south-east and north-west).

Groundwater discharge, as springs and seeps, are observed on the sides of hills in the mine development area. These areas are typically dammed for agricultural use. The seeps (and dams) are ephemeral and some have been observed to run dry over the baseline monitoring period.

A separate assessment has been prepared regarding surface water – groundwater interactions in the mine development area (Appendix K). The following provides a summary of that assessment.

- Within the mine development area, several dams have been recorded and many have been sampled for water quality analysis or are included in the regular sampling conducted by Regis.
- Field surveys of springs have been conducted between May 2013 and March 2019 on five separate occasions to identify and monitor springs in the mine development area. Overall, 36 springs have been identified.
- Three springs have been included in Regis' regular sampling rounds since 2017, providing two years of baseline water quality data, an additional two springs have been added to the regular sampling round in March 2019.

Environmental isotopes, stable and radioactive, occur naturally in the atmosphere and hydrosphere in varying concentrations. Generally, the most commonly used environmental isotopes include isotopes of water (oxygen-18, deuterium (H^2) and tritium (H^3) and carbon (carbon-13 and carbon-14) which naturally occur in water. Environmental isotopes are used to assess water age, groundwater recharge and discharge processes, flow and interconnection between aquifers and surface water-groundwater interactions. Radioactive isotopes (tritium and carbon-14) occurring in water originate from cosmogenic nuclear reactions and nuclear testing conducted in the 1950s.

An isotope investigation was undertaken in May 2017 to help characterise recharge sources and groundwater residence times. The results of the isotope assessment and other laboratory reported water quality for samples collected from the Belubula River, springs, dams and groundwater monitoring bores (multiple lithologies) are discussed in Appendix K.

- The water chemistry at springs WES1164A and WES4660A, watercourse location WED3466A and dam sites WED3662A, WEED3052A and WED1825A are similar to groundwater which suggests that these locations may receive groundwater discharge from the Anson Formation.
- The water chemistry at spring WES5669A is different to the water chemistry at nearby monitoring bore WMB5872A (Anson Formation). This suggests that the source of water for this spring is not from the Anson Formation at this location.

- The water chemistry at the eastern most sampled dams and springs (WED1276A, WED3275A, WED4775A and WES7729A) indicate that these sites are fresher than the local groundwater, have low residence times and/or have had limited interaction with underlying rock material. This suggests that the dams capture surface water/overland flow and the source of water at spring WES7729A is shallow groundwater.

- The isotope results indicate that groundwater age ranges from modern to >1,000 years.

- Stable isotope, tritium and radiocarbon (WED2128 only) results indicate that the surface water sites sampled during this investigation generally have a different (younger) source of water when compared to the groundwater samples. This is to be expected given that the sites receive direct rainfall and runoff during high rainfall events.

The spring locations identified by the project have been classified as either:

- fault springs – these occur where groundwater is forced to the surface upon encountering a low permeability 'clay filled' fault zone. The source of the fault springs is likely to be the deeper groundwater system;

- highland seeps – present in elevated areas where groundwater infiltrating though shallow, weathered rock intersects a break of slope in the ground surface; or

- highland springs – similar to highland seeps. Water discharge occurs in areas where the low permeability near-surface weathered rock is located closer to the surface or 'breaks out' at the ground surface. Due to the low permeability layer at the base of the weathering zone, groundwater is forced upwards and discharges at ground surface.

The spring classification has been based on the conceptual hydrogeological understanding, the topographical location of the springs and water chemistry and is summarised in Appendix K.

The majority of the identified springs are associated with the shallow, locally recharged, groundwater flow system (ie perched and short flow path groundwater systems). The results of the groundwater assessment indicate that these springs do not contribute significant flows to the Belubula River.

9.2.5 Potentially sensitive receptors

Groundwater receptors identified within the area include:

- third party bores; and

- potentially groundwater dependent ecosystems (GDEs), including:

  a) aquatic ecosystems;

  b) terrestrial ecosystems; and

  c) subterranean ecosystems.

i Third party bores

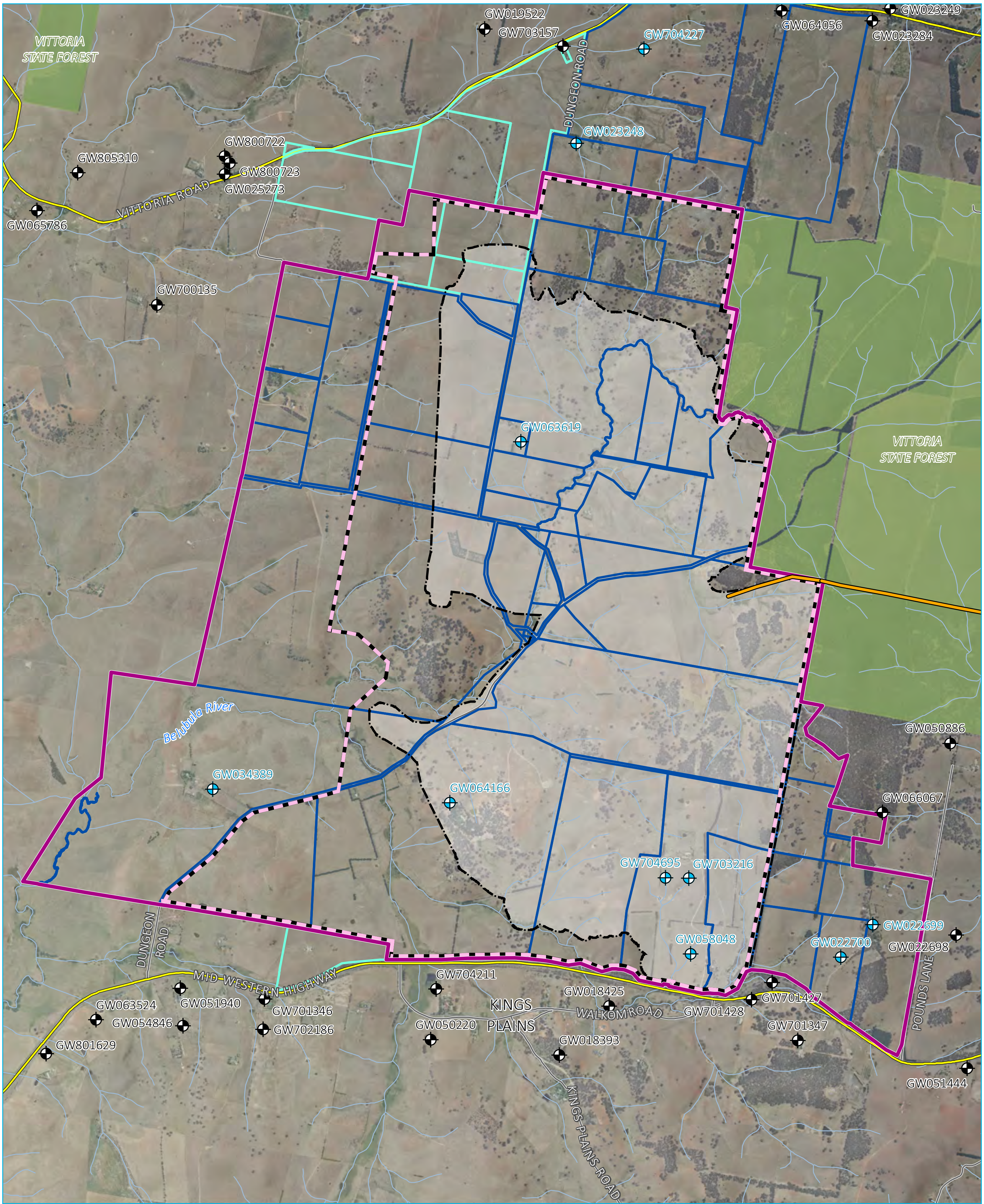
A search of the WaterNSW database and bore census surveys identified 254 bores within a 10 km radius of the mine development area. Registered bores within approximately 2 km of the mine development area are presented on Figure 9.10. Landholder bores visited as part of bore census surveys conducted by Regis are identified in Table 9.6.

There are a number of registered bores that have limited data available, including groundwater level and quality data. Available groundwater levels and quality data have been used in the Groundwater Assessment (refer Appendix K).

Table 9.6 Third party bores – Regis census

Regis ID	WaterNSW ID	Inferred lithology	Easting	Northing
WRB0064A	GW018393	Byng Volcanics	716510	6290047
WRB0340A	GW702186	Blayney Volcanics	714085	6290398
WRB0469A	NA	Anson Formation	716971	6290404
WRB0555A	NA	Blayney Volcanics	715548	6290592
WRB0671A	NA	Anson Formation	717120	6290615
WRB0750A	GW050220	Blayney Volcanics	715073	6290772
WRB0772A	NA	Anson Formation	717251	6290720
WRB2535A	GW034389	Blayney Volcanics	713582	6292597
WRB2556A	GW064166	Anson Formation	715640	6292552
WRB5208A	NA	Blayney Volcanics	715293	6290812
WRB5308A	GW704211	Blayney Volcanics	715382	6290869
WRB5408A	NA	Blayney Volcanics	715469	6290837
WRB6208A	GW018425	Byng Volcanics	716209	6290864
WRB1071A	NA	Anson Formation	717124	6291009

Notes: NA – not available



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

- Registered groundwater monitoring bore within project boundary
- Registered groundwater monitoring bore - other
- Regis-owned property
- Property under option

Existing environment

- Main road
- Local road
- Watercourse/drainage line
- State forest

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Locality plan of registered bores within 2 km – mine project area

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Figure 9.10

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ii Groundwater dependent ecosystems

While regional groundwater systems provide water sources for livestock and other anthropogenic uses, groundwater also supports surface (above ground) and subsurface (below ground) ecosystems that can be beneficial users of groundwater. GDEs identified in the project area are shown in Figure 9.11.

A review of the relevant WSPs, BoM GDE Atlas, relevant legislation and other literature was conducted to understand local GDEs. Based on the desktop review of available information, the nearest high priority GDE (The Spring) is located 16 km east of the mine development area.

Chapter 14 (Aquatic ecology) of the EIS provides a description of the aquatic environment in the area of the project.

As described in Section 9.2.4, a total of 36 springs have been identified in the mine development area. Several identified ephemeral springs are located within the proposed TSF footprint. Further discussion on springs and surface water-groundwater interaction is provided in Appendix K.

No terrestrial ecosystems have been identified and mapped on the GDE Atlas within the mine development area. However, vegetation mapping conducted by EMM (refer Chapter 13 (Terrestrial biodiversity)) identified one plant community type (PCT) which is thought to be opportunistically reliant on groundwater.

Field surveys identified that vegetation within the mine development area has experienced historic pastural use with some fragmented patches of timbered natural vegetation scattered throughout. Field surveys also recorded four native PCTs, comprising:

- Blakely's Red Gum Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277), which is listed as an endangered ecological community (EEC) under the NSW *Biodiversity Conservation Act 2016.* Patches of this PCT in moderate to good condition also represent White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands, listed as a critically endangered ecological community (CEEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999;*

- Broad-leaved Peppermint – Brittle Gum – Red Stringybark dry open forest of the South Eastern Highlands Bioregion (PCT 727);

- Mountain Gum – Manna Gum open forest of the South Eastern Highlands Bioregion (PCT 951); and

- Carex sedgeland of the slopes and tablelands (PCT 785).

The PCT 951 represents an ecosystem with a facultative and opportunistic dependence on groundwater. PCT 951 is thought to use groundwater where available but can exist without its input. It is thought to have a greater reliance on groundwater during times of prolonged drought.

All other PCTs are considered non-dependent as they comprise drier terrestrial vegetation that does not overlie shallow groundwater areas and rely on rainfall for ecosystem functioning.

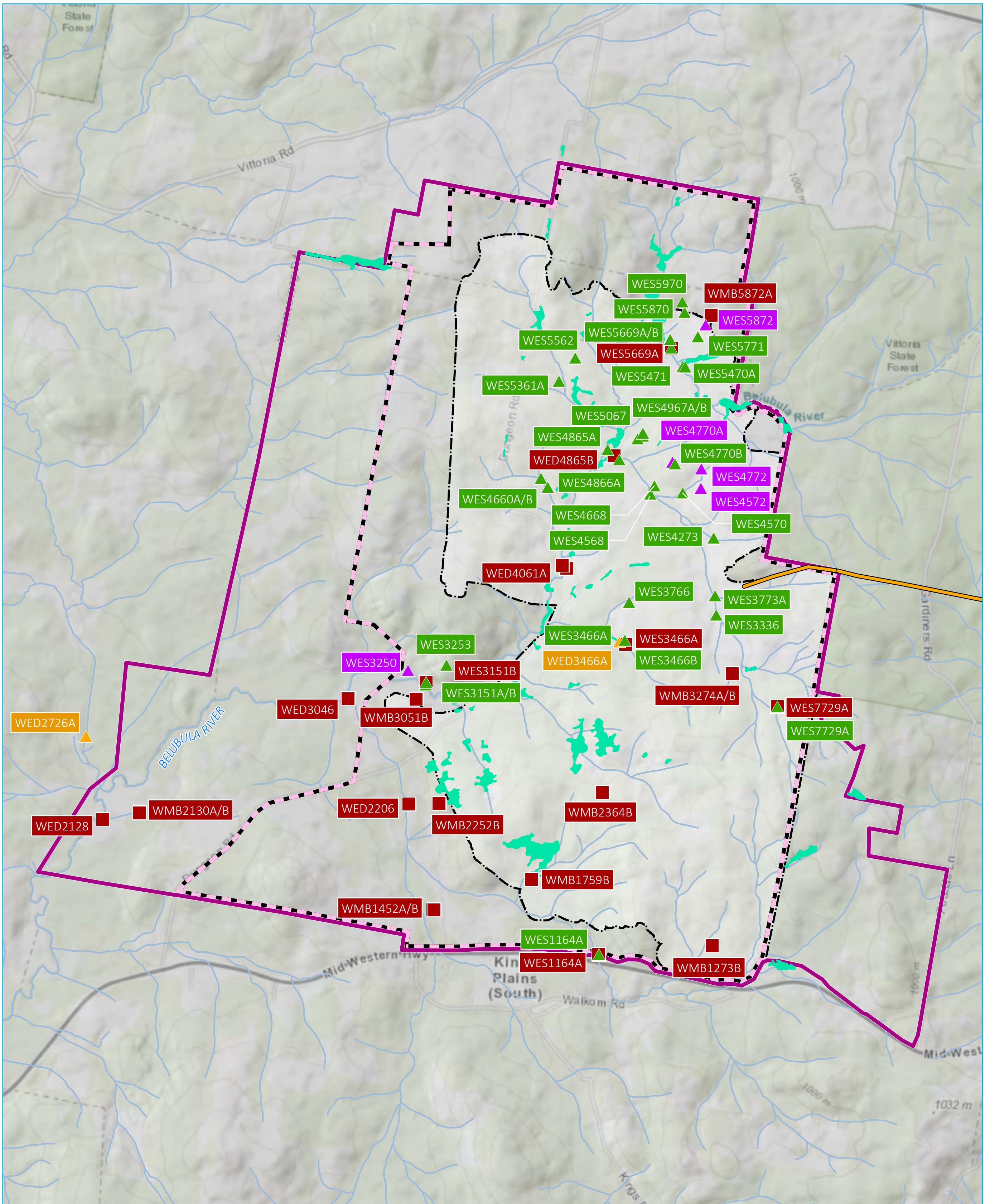
A subterranean fauna assessment was conducted at 23 sites (13 bores, five springs and five streams) by Invertebrate Identification Australasia (2019) on behalf of Regis in 2017 (refer Figure 9.11). The subterranean fauna assessment is summarised in Appendix K. The only sites that recorded fauna were the surveyed spring sites. Some of the macroinvertebrates that were identified may be dependent on groundwater discharge, however the fauna were not identified in the aquifer. No listed threatened species were collected.

As no stygofauna have been identified in the geology in the project area, drawdown induced from mining will not affect stygofauna or their habitats. The GDE Atlas and relevant WSPs have not identified subterranean ecosystems within the project area. Two springs were identified as having high ecological value due to the presence and diversity of the macroinvertebrate fauna.

These springs are inferred to be associated with the shallow, locally recharged, groundwater flow system and are located away from the open cut mine but within the proposed project disturbance area.

9.2.6 Conceptual model

The conceptual hydrological and hydrogeological model for the project has been developed based on the information presented above, and in Appendix J and Appendix K. Figure 9.12 is a schematic illustration of the conceptual model under existing conditions.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPE (2015); ELVIS (2014)

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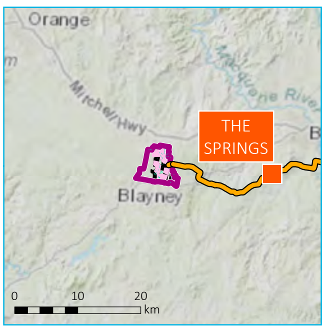

KEY

- High-priority GDE (refer to inset)
- Stygofauna sample location
- Seepage area
- Spring
- Watercourse
- Watercourse/drainage line
- PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

Sensitive receptor and subterranean fauna survey locations

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Figure 9.11

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Key

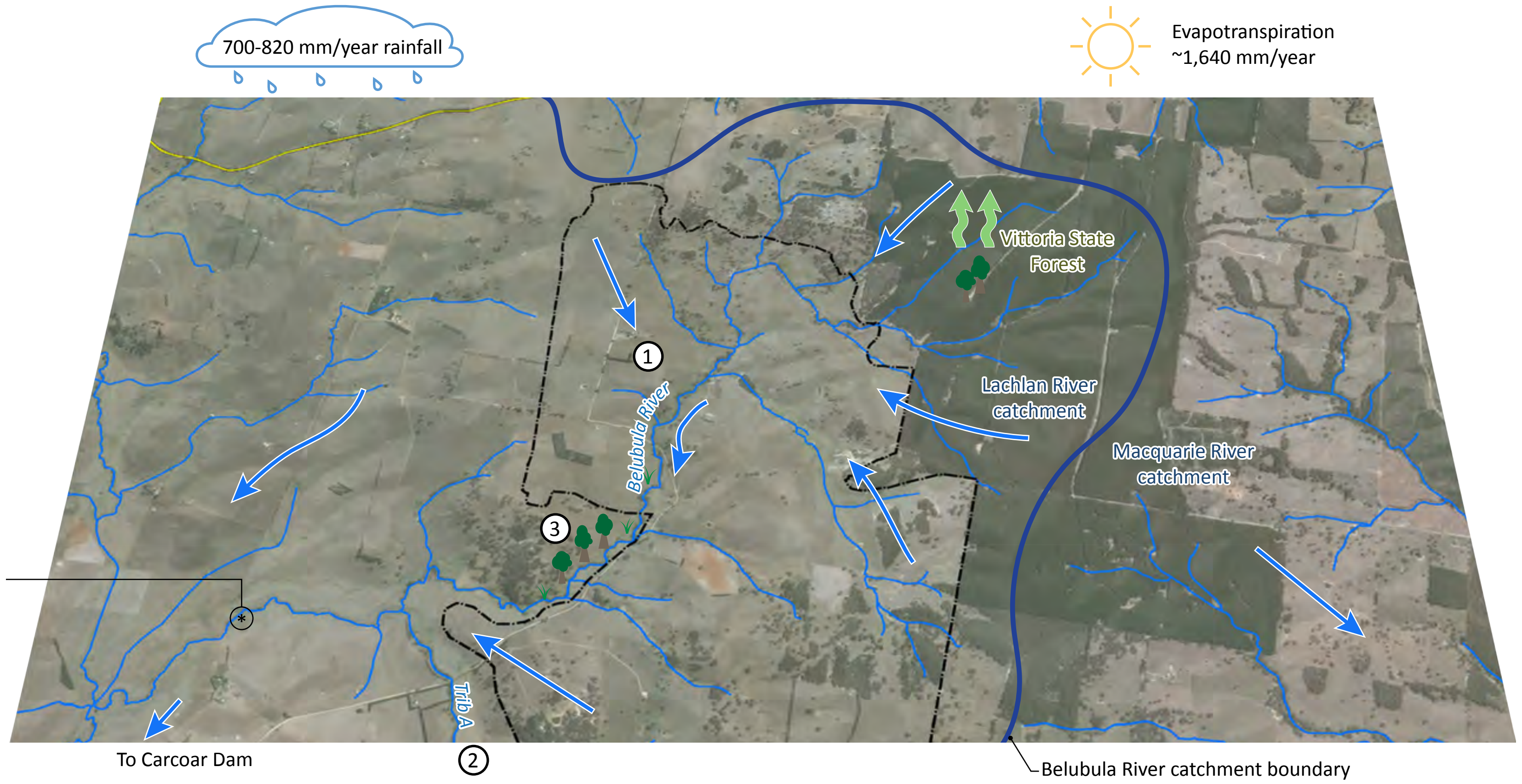
- Alluvium
- Byng volcanics
- Blayney Volcanics
- Anson Formation
- Cunningham Formation
- Carbonaceous alteration
- Tertiary basalt
- Weathered zone
- Disturbance Boundary
- Geological structure
- Groundwater flow direction
- Surface water flow direction
- Evapotranspiration
- Rainfall recharge
- Watercourse
- Watertable
- Main road
- Fault directional movement

1. The catchment area of the upper reaches of the Belubula River (above the confluence with Trib A) is 17.5 km².
2. Trib A catchment area is 24.4 km².
3. PCT 951 Mountain Gum – Manna Gum open forest is an opportunistic user of groundwater during periods of prolonged drought.
4. Tributaries in upper Belubula River catchment are dry most of the year and are not connected to the watertable.
5. At the lower reaches of the Belubula River and Trib A, groundwater discharges to the watercourse.
6. The hydraulic conductivity of the Byng Volcanics is lower than the Anson Formation and therefore will transmit water at a slower rate than the Anson Formation. The hydraulic conductivity of the fresh volcanics and metasediments is very low, as seen in the core testing and observations at Cadia.

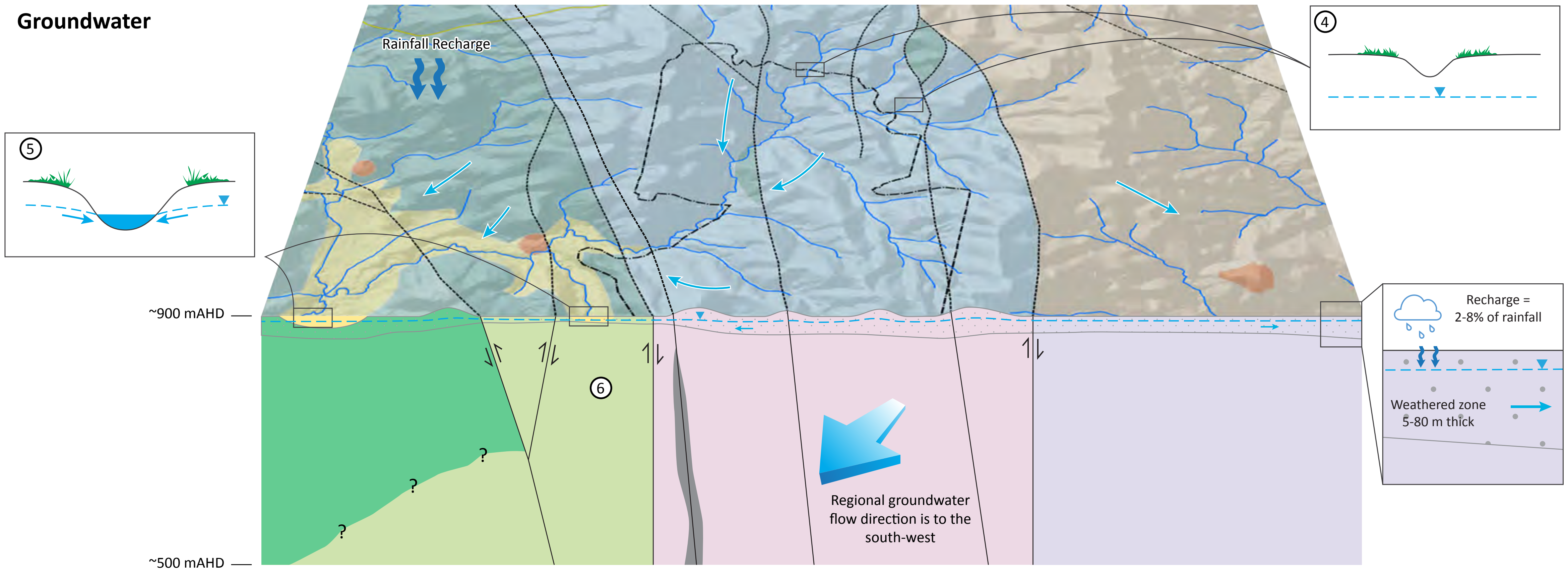
NOT TO SCALE

Surface Water

- At Carcoar dam, surface flows are usually >1,463 ML/year (95% of the time).
- At the Mid Western Highway (station 412104), surface flows are usually 273 ML/year (95% of the time).
- At the proposed downstream gauging station, surface flows are usually 697 ML/year (95% of the time).



Groundwater



Regional conceptual hydrology and hydrogeological model - existing conditions

McPhillamys Gold Project
Regis Resources

Figure 9.12

9.3 Assessment approach

The assessment of project-related impacts to water resources and water users considers the requirements of the WM Act 2000, the relevant WSPs and the AIP. The assessment also considers consultation undertaken with the NSW Government through the project development.

9.3.1 Potential impacts to water users

Water affecting activities that have the potential to impact water resources and water users are as follows:

- the construction and use of site infrastructure;
- the interception of groundwater via open cut mining; and
- on-site water and tailings storage.

Changes to the baseline conditions caused by these activities are termed 'direct impacts'. Direct impacts in relation to groundwater and surface water could be changes:

- in surface water quantity, including changes to surface water flow and levels, and water availability;
- to surface water quality, including changes in salinity and salt balance, and concentrations of other water quality parameters (such as pH, major ions, metals, hydrocarbons and nutrients);
- to flooding regime;
- in groundwater quantity, including changes to groundwater levels/pressures and flow; and
- in groundwater quality, including changes in salinity, and concentrations of other water quality parameters (such as pH, major ions, dissolved metals, hydrocarbons and nutrients).

The following summarises groundwater receptors that may be affected by the mining activities (indirect effects):

- ecosystems that potentially rely on groundwater;
- watercourses, drainage lines, creeks and springs that receive baseflow;
- groundwater users (third party bores and associated infrastructure);
- surface water users; and
- surface water environments.

The direct and indirect effects of the project on water resources has been assessed using thresholds defined in the AIP.

9.3.2 Adopted criteria

Based on the relevant assessment requirements, site appropriate assessment criteria have been developed for both surface water and groundwater-related impacts. These are presented in the following sections.

i Groundwater

As mentioned above, the mine development has been assessed against the minimal impact thresholds defined in the AIP. Impacts to groundwater are assessed via the consideration of high priority GDEs, high priority culturally significant sites, and third-party bores.

The AIP divides groundwater sources into 'highly productive' or 'less productive' based on the yield (>5 L/sec for highly productive) and water quality (<1,500 mg/L total dissolved solids (TDS) for highly productive). Thresholds are set in the AIP for the different groundwater sources for the different minimal impact considerations. Based on DPI Water's mapped areas of groundwater productivity in NSW (DPI Water 2012), the project is within a 'less productive' porous and fractured rock source. The applicable minimal impact considerations are listed in Table 9.7

Table 9.7 Minimal impact criteria for 'less productive' porous rock water source

Impact level	Watertable	Water pressure	Water quality
Level 1 impact (ie less than minimal)	1. Less than or equal to 10% cumulative variation in the watertable, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan. A maximum of a 2 m decline cumulatively at any water supply work.	1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work.	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.
Level 2 impact (ie greater than minimal)	2. If more than 10% cumulative variation in the watertable, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies (including the hydrogeology, ecological condition and cultural function) will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than a 2 m decline cumulatively at any water supply work then make good provisions should apply.	2. If the predicted pressure head decline is greater than requirement 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

Notes: Source: AIP DPI Water 2012.
1. 'post-WSP'– refers to the period after the first WSP in the water source begins, including the highest pressure head (allowing for typical climatic variations) within the first year after the first WSP begins.
2. 'Appropriate studies' on the potential impacts of watertable changes greater than 10% are to include an identification of the extent and location of the asset, the predicted range of watertable changes at the asset due to the activity, the groundwater interaction processes that affect the asset, the reliance of the asset on groundwater, the condition and resilience of the asset in relation to watertable changes and the long-term state of the asset due to these changes.
3. All cumulative impacts are to be based on the combined impacts of all 'post-water sharing plan' activities within the water source.

ii Streamflow

Potential impacts associated with the change in flow regime as a result of the project could include:

- decreased access for water users as a result of decreased streamflow due to reduced catchment area and intercepted baseflow; and
- decreased availability of water for instream and riparian ecosystems as a result of decreased streamflow due to reduced catchment area and intercepted baseflow.

Criterion for assessing impacts to water quantity is the estimate reduction in annual flow under various climatic conditions and comparison against existing flow conditions.

iii Water quality

The project has been assessed to have the potential for surface water and groundwater quality changes as a result of:

- spills from hazardous materials contained on site;
- spills from the operational water management system;
- un-intercepted runoff from areas requiring erosion and sediment control treatment prior to flowing offsite (ie topsoil stockpiles);
- exposure of Acid Sulphate Soils (ASS);
- seepage from the TSF to the watertable and the Belubula River;
- seepage from the waste rock emplacement (including AMD risk), water management facilities, or runoff from the ROM Pad to the watertable;
- introduction of varying water quality via the water supply pipeline; and
- production of brine from an onsite Reverse Osmosis (RO) plant.

Potential impacts to surface water and groundwater quality associated with the first four hazards in the list above can be suitably managed through implementing a project-specific environmental management plan and through design controls (refer Section 9.7). The Soils Assessment (Chapter 7) assessed the potential for ASS as a risk for the project. The NSW ASS Risk Map (OEH 2018) indicates that the nearest site with a high probability of occurrence of ASS is further than 100 km from the mine development and is 900 m lower in elevation. As such, there is little risk of ASS in the mine development area.

The latter four hazards in the list above have been further assessed.

Criteria for assessing impacts to water quality is deviation from baseline quality and altering the beneficial use category of the water source (consistent with the AIP and WM Act 2000).

iv Flooding

The following features are noted in line with the NSW Floodplain Development Manual (NSW Government 2005):

- flood prone land;
- flood planning area; and
- floodway areas.

Flood prone land is defined as land susceptible to flooding during a Probable Maximum Flood (PMF) event (NSW Government 2005). Flood planning areas are assumed to be approximately equivalent to the 1% Annual Exceedance Probability (AEP) flood extent. Floodway areas are defined as areas where significant discharge occurs during floods and are often aligned with naturally defined channels (NSW Government 2005). This has been interpreted as being effective bankfull flow. For the purposes of this study and in the context of the project being located in the headwaters of the Belubula River, this has been assumed to be approximately the 10% AEP flood level.

Changes to the flood regime may affect local land users within and next to the project area. As the mine development area is in the headwaters of the catchment, localised flooding impacts would be confined to land owned by Regis.

Criteria for assessing impacts to the flood regime include changes in flow and flood heights, up to 10% AEP flood level.

9.3.3 Cumulative impacts

In the context of water resources potentially impacted by the mining development, there has been significant past development in the upstream, immediate and downstream catchment areas since European settlement, including widespread agricultural development, land clearing and historical mining operations. There has also been significant development of the surface water resources themselves, including regulation and extraction of water from local and regional surface water resources (ie Carcoar Dam). The effects of past development are inevitably incorporated into the baseline descriptions of surface water resources developed for the mining development which are based on contemporary monitoring.

The closest mining operation is Newcrest's Cadia Valley Operations, approximately 25 km west of the mine development. Groundwater abstraction from the Orange Basalt also occurs from around 4 km north-west of the mine development.

The extent of groundwater drawdown from the project is predicted to be localised and steep and will not draw on groundwater from the Orange Basalt groundwater source. In addition, the Cadia operations are sufficiently far from the McPhillamys project that impacts from the mining operation will not extend to the McPhillamys project.

There are no other mining developments and no potential future projects in the planning process located in the Carcoar Dam catchment, hence there are no cumulative mining impacts expected during operations.

Given the above, the cumulative impacts on water resources are not expected to be significant.

9.4 Methodology

Numerical modelling and analytical techniques have been used to develop the site water balance, investigate potential changes in flood extent, and predict water quantity and quality changes to surface water and groundwater resources. Full technical reports detailing methods are included for each assessment in Appendix J and Appendix K. A brief summary of the methodology for each component of the assessment is included in the following sub-sections.

9.4.1 Water balance

i Site water balance

A GoldSim based water balance has been developed to simulate the management of the operational water system over the mine development project life. The model enables assessment of mine development water supply/ demand and risks, and informs infrastructure sizing, including assessment of:

- the project water balance, showing proportions of inflows and outflows;
- water supply reliability for future demands;
- the risk of disruption to mining as a result of excess water in the open cut;
- the risk of spill from externally spilling dams; and
- the external supply requirement.

A detailed description of the model design, assumptions and assessed scenarios is included in Appendix J.

The model operates on a less than daily time step and simulates 129 "realisations" derived using historical daily climatic data[3] from 1889 to 2017 over a 10 year simulation period. The first realisation uses climatic data from 1889 to 1898, the second uses data from 1890 to 1899 and the third from 1891 to 1900 and so on. This method effectively includes all recorded historical climatic events in the water balance model, including high, low and median rainfall periods.

A schematic of the site water management system is presented in Figure 9.14.

a Simulated future performance

Model predicted average inflows and outflows (averaged over the 10 year simulation period and all realisations) are shown in Figure 9.13.

In summary, operational water balance forecasts for the mine development include:

- water supply via the external pipeline provides the greatest average modelled system inflow, while the largest average outflow comprises supply to the process plant;
- the forecast median stored water inventory varies between 1,300 ML and 2,300 ML once the Secondary WMF is commissioned. Prior to the Secondary WMF being commissioned the operational water management system does not have the capacity to store a large volume of water on site to buffer supply during dry times;
- model simulations indicate the risk of a haul road dust suppression shortfall prior to the external supply pipeline being commissioned. However, the overall predicted average supply reliability is reasonably high, with greater than 96.1% of the demand able to be supplied. No shortfalls are predicted once the external supply pipeline has been completed;
- model predictions suggest that on average, there would be less than seven days per year where stored water volume in the open cut exceeds 200 ML. These results indicate that there is a low risk that mining operations would be significantly impacted by rainfall;

[3] Data sourced from the SILO Data Drill for the project location (refer Appendix J).

- under average climate conditions, 2,342 ML/year would be sourced from the external pipeline. Model results suggest that under periods of lower rainfall, the external supply pipeline will be utilised to its full capacity; and

- predicted annual spill risk for each WMF is in line with the design criterion (ie less than 1% spill risk for WMF1, WMF2, WMF3, WMF4, the Primary WMF and the TSF Runoff Interception WMF, and no simulated spills from the Secondary WMF or the TSF).

b Climate change effects

Investigations of the effects of future changes in climate have been undertaken using the online Climate Futures Tool (CSIRO and BoM 2015). Projected changes in rainfall and evapotranspiration from all regionally appropriate climate models were considered, as these are the most relevant available parameters affecting rainfall runoff. The investigations assumed a conservatively high emissions scenario. Investigations were performed for 2030 (ie at the end of the mine development life) and 2090 (latest projected year available – which is of relevance for the post-mine period).

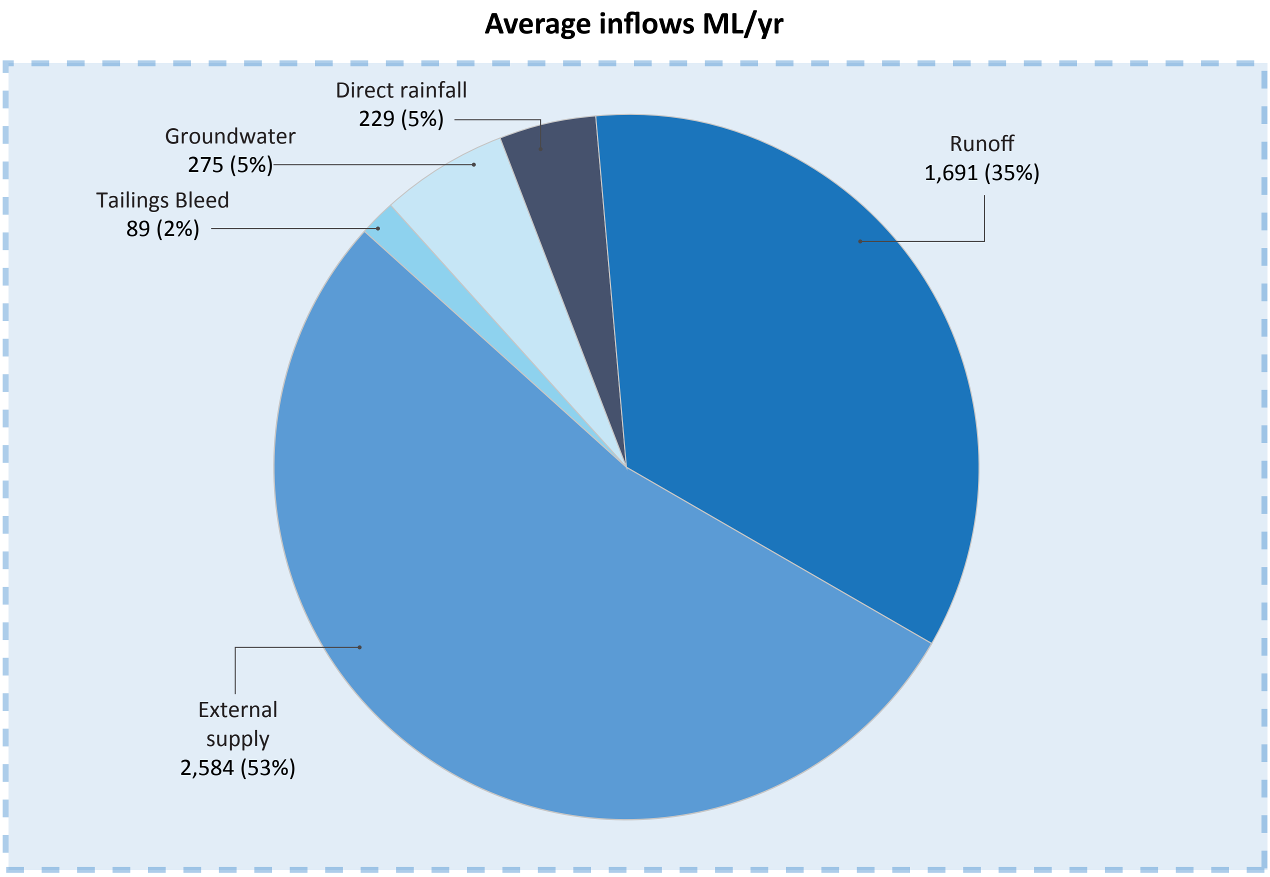
An assessment was carried out of the change in extreme (1:20 AEP) annual rainfall. The predicted most likely scenario by 2030 is for “little change” or a “small increase”, while by 2090 the prediction is for a “small increase”. The implications of climate change predictions on water management are unlikely to be significant over the life of the mine development because they are fairly small compared to natural climatic variability and the relatively short duration of the mine development.

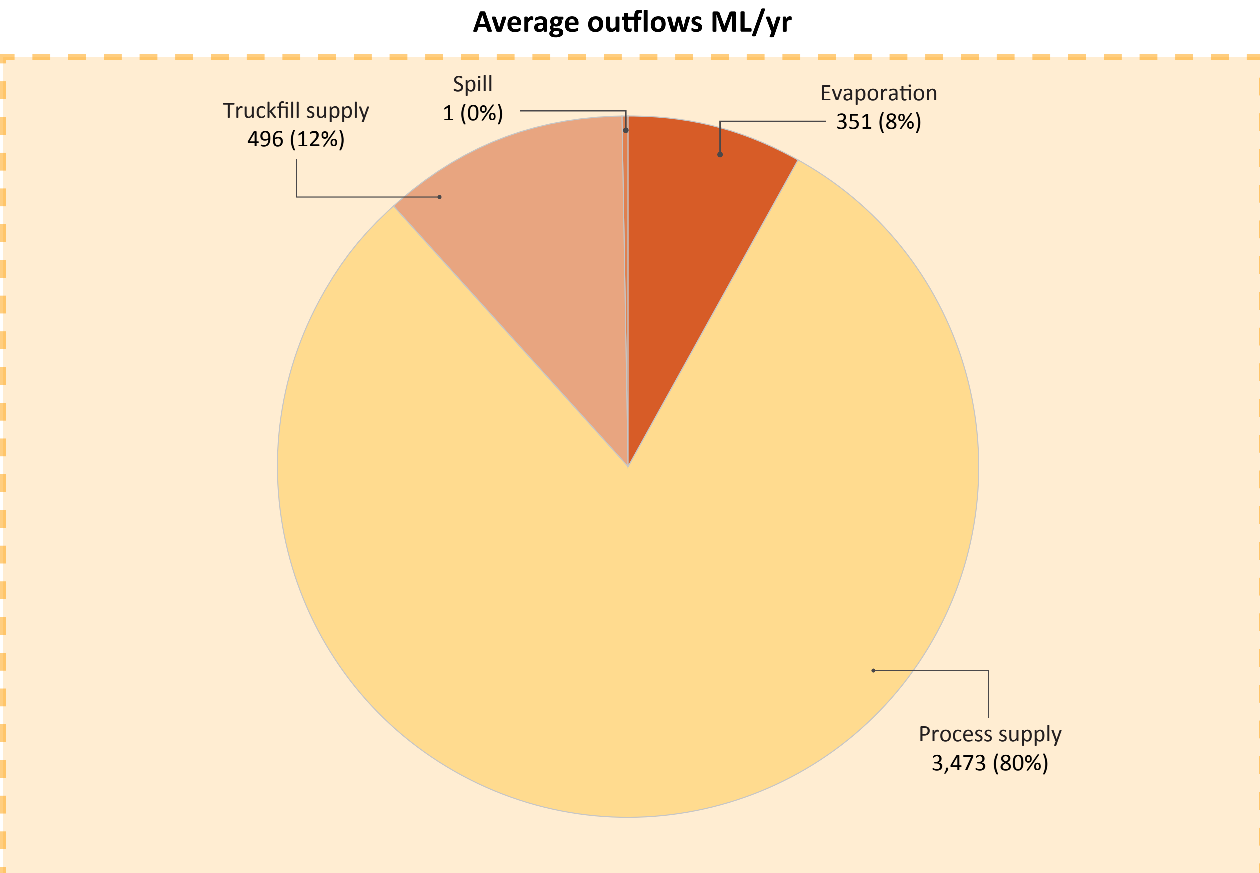
ii Final void water balance

Post-mining, all mining areas, except the final void catchment, will be regraded to a stable landform and revegetated. All disturbed areas, except the final void, will be rehabilitated. Several permanent clean water diversion channels will be constructed to allow for a free-draining landform. A clean water diversion channel will be constructed adjacent to the northern boundary of the open cut area to divert upslope runoff to the Belubula River. The design and alignment of these diversion channels will be confirmed during detailed mine design.

A daily timestep, final void water and salt balance model has been developed using GoldSim to assess the final pit lake recovery. The model simulates the volume and salinity of the final void water body by simulating the inflows (including rainfall runoff, direct rainfall and groundwater inflow), outflows (evaporation) and resultant volume of water and salt mass. The 129 year historical climate record was repeated several times over to generate an extended period of data for the final void simulation.

Appendix J provides details regarding the model design, assumptions and results.

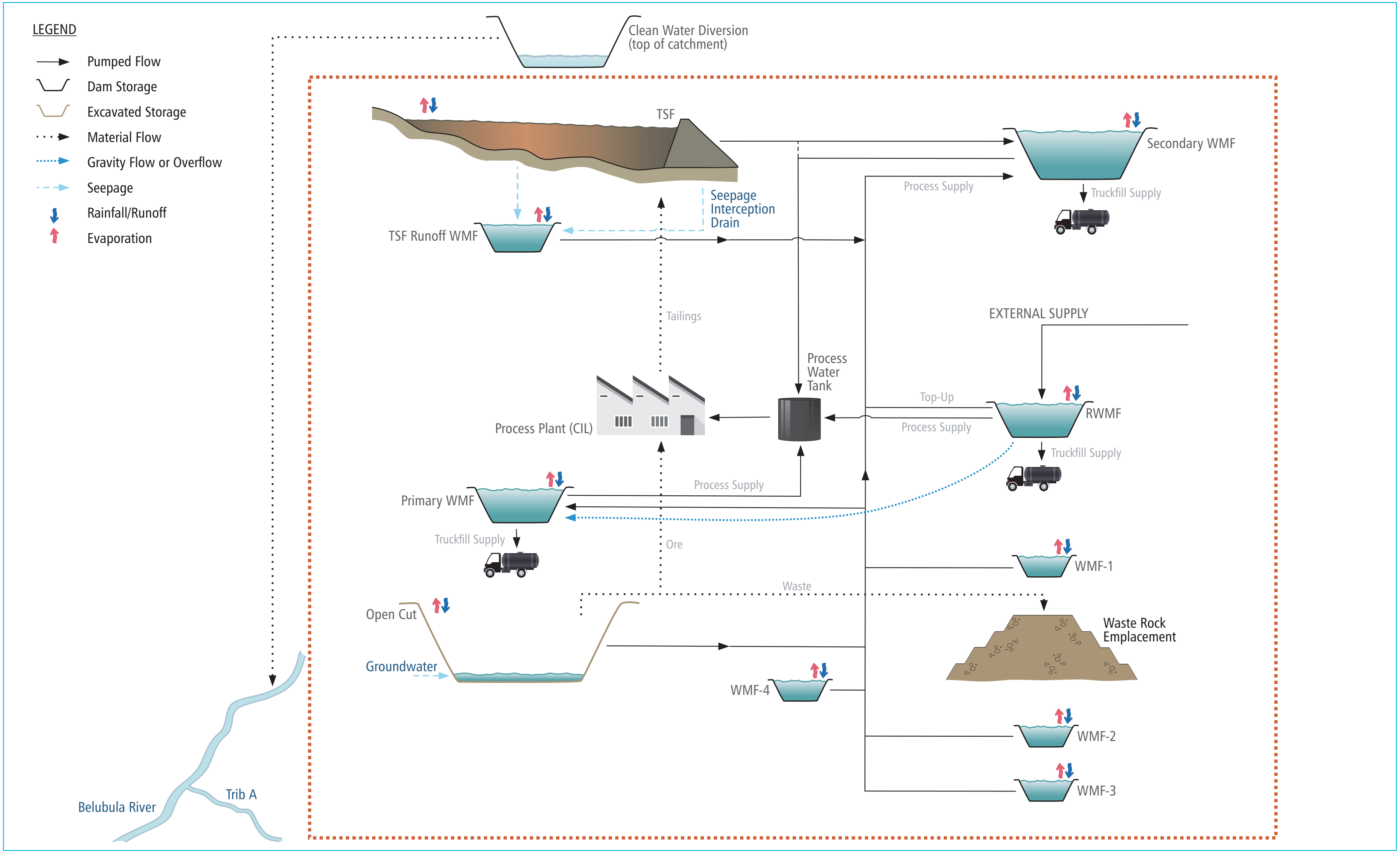




Note: average inflows will not equal average outlfows due to statistical variation and the change in water stored on site.

Reference: HEC 2019

Average predicted mine development water balance



Simplified site water management and process diagram

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Figure 9.14

9.4.2 Groundwater flow modelling

A regional groundwater numerical flow model using MODFLOW-USG (Panday et al 2013) has been developed to represent the conceptual hydrogeological understanding and assess the influence of the mine development on the groundwater system. The model was developed in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al 2012) and aligns with a Class 1 model.

A Class 1 model is fit-for-purpose as the groundwater sources in the mine development area are not considered highly productive aquifers. Model predictions are used to assess the potential impacts of the project and uncertainty analysis conducted to address uncertainty in model parameters. The Australian Groundwater Model Guidelines (Barnett et al 2012) indicate that a Class 1 model may be appropriate for assessing potential impacts for an EIS level assessment in such an environment.

The key objectives for the groundwater model are to:

- provide a numerical representation of the conceptual hydrogeological model;
- assess the likely extent and magnitude of groundwater drawdown induced by mine dewatering and related effects post-mining;
- predict changes to availability of groundwater for sensitive receptors in the immediate and wider vicinity of the project;
- assess the potential changes to the groundwater flow directions and heads as a result of the TSF during operations and post-mining;
- provide information that can be used to assess the impacts of the TSF on groundwater quality; and
- provide outputs to assist with the site wide water balance.

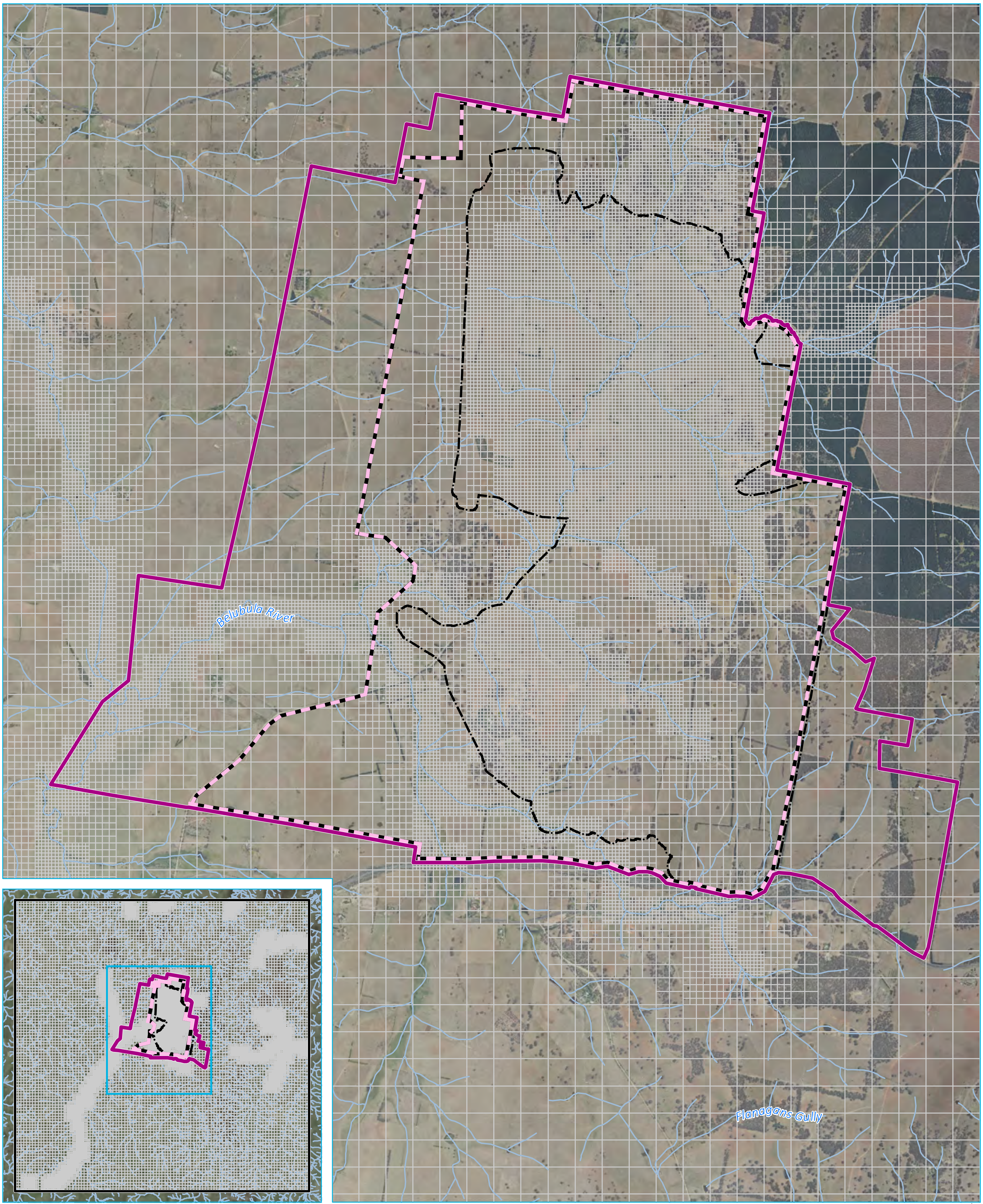
TSF design and assessment of the effectiveness of the TSF seepage management measures has been conducted by ATC Williams (2019). The primary purpose of the groundwater model is to assess the potential impacts of the TSF on the groundwater flow system therefore the simulation of the TSF seepage is deliberately conservative in the groundwater assessment.

The model domain covers a square domain of 20 km by 20 km, centred on the mine development area and was chosen to be adequately large enough to include the main hydrogeological boundary conditions influencing groundwater flow; and changes to the groundwater system in relation to mine dewatering and tailings seepage. The model domain is shown in Figure 9.15. Nine layers have been employed to represent the regional HSUs, orientation of geological units and to allow for simulation of mining. Full details of the model design and calibration are provided in Appendix K. The model has been independently peer reviewed and deemed fit for purpose.

The numerical model was interrogated for sensitivity to certain hydrogeological parameters, including hydraulic conductivity and river stage. The sensitivity analysis suggests that the model is most sensitive to the hydraulic conductivity of the weathered bedrock (volcanics and metasediments).

Predictive simulations have been run for the 10-year mine plan and for 100 years after mining to aid assessment of the objectives listed above.

Uncertainty analysis has been conducted to better understand how the prediction results may vary due to inherent uncertainty within the system, which is introduced by effects of error in field measurements, conceptual, spatial and temporal simplifications, and limitations with available data. The uncertainty analysis included the scenarios explored in the sensitivity analysis, as well as scenarios assessing variability in specific yield and specific storage, and simulating the Belubula River and Trib A as dry drainage lines.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 55

KEY

Model boundary

Model grid

Project application area

Mine development project area (2,513.47 ha)

Mining lease application area (1,812.99 ha)
(Note: boundary offset for clarity)

Disturbance footprint

Watercourse/drainage line

Groundwater numerical model domain

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Figure 9.15

9.4.3 Surface water flow assessment

The main potential surface water impact during the operational phase of the project is reduced streamflow in the Belubula River and hence inflows to Carcoar Dam due to the reduction in catchment associated with the operational water management system.

Changes to streamflow in the Belubula River, and subsequent changes in inflows to Carcoar Dam, during mine development and post-closure has been assessed using a GoldSim water balance model. The rainfall-runoff component of the model was calibrated against available surface water flow data. Appendix J includes details regarding the model design and assumptions.

9.4.4 Water quality assessment

As discussed in Section 9.3.2, the following hazards have been assessed for potential surface water and/or groundwater quality changes as a result of the project:

- seepage from the TSF to the watertable and the Belubula River;
- seepage from the waste rock emplacement (including AMD risk), water management facilities, or runoff from the ROM Pad to the watertable;
- introduction of varying water quality via the water supply pipeline; and
- production of brine from an onsite RO plant.

The first three hazards have been assessed utilising results of a geochemical assessment (SRK 2019), the TSF design report (ATC Williams 2019) and outputs of the groundwater model.

Post-mining, as described in Chapter 22, all mining areas, except the final void catchment, will be regraded to a stable landform and revegetated post-closure. All disturbed areas, except the final void, will be rehabilitated and several permanent clean water diversion channels will be constructed to allow a free-draining landform.

The geochemical assessment focused on the geochemical characteristics which have the potential to exert a detrimental environmental influence or could influence the success of mine rehabilitation (SRK 2019). The geochemical assessment is provided in Appendix G. Below is a summary of the key results of the assessment:

- the sampled ore and tailings material have been classified as PAF;
- waste material is expected to be a combination of PAF (42% of waste) and NAF;
- the exposed walls of the open cut mine will have PAF material and may result in acidic mine water inflows during operations and post-closure; and
- localised generation of acid and metalliferous drainage (AMD) is anticipated in the TSF, where unsaturated conditions occur in beach areas and this will generate seepage which will either collect in the decant or seep into the TSF. Acidic seepage into the TSF during operations may be neutralised by ANC within the tailings.

Based on the geochemical assessment conducted, the following analytes have been identified as indicators of leachate seepage from waste material and the TSF:

- pH;

- salinity (as TDS or EC);

- silver (Ag), As, barium (Ba), bismuth (Bi), Cd, cobalt (Co), copper (Cu), mercury (Hg), manganese (Mn), molybdenum (Mo), lead (Pb), sulphate (SO_4), sulphur (S), antimony (Sb), selenium (Se), nickel (Ni), aluminium (Al) and zinc (Zn).

This information has informed the surface water and groundwater quality assessment.

9.4.5 Flooding assessment

A simplified flooding assessment has been completed for the project in consultation with OEH. OEH confirmed (I Rivas 2019, pers. comm. 27 February 2019) a simplified flooding assessment would be satisfactory based on the following:

- as the mine development is in the headwaters of the Belubula River, the flooding risk resulting from upstream floodwaters would be minor;

- the open cut is located no closer than 250 m from the Belubula River; and

- as the mine development will capture runoff from disturbed areas (most notably the TSF, waste rock emplacement area and open cut), resulting in a reduction in catchment area reporting downstream, the impact on flooding to downstream floodwaters would be a reduction in total flow downstream of the mine development.

Flow calculations for a range of design rainfall events (10%, 1%, 0.5%, 0.2%, 0.1% and PMF) have been modelled using analytical calculations for a point adjacent to the proposed open cut mine.

Peak flood levels were estimated using analytical calculations for a cross-section located at approximately the confluence of Trib C and the Belubula River, where there is minimal elevation difference between the edge of the open cut mine and the Belubula River. The assessment considered the existing scenario and at the maximum mine development scenario.

Appendix J includes details regarding the analytical calculations and assumptions.

9.5 Impact assessment

The outputs of the modelling (numerical and analytical) were used to assess the potential impact of the project activities on water resources in and surrounding the project area. The results for both surface water and groundwater impact assessments (Appendix J and Appendix K) are summarised in the following sub-sections.

9.5.1 Groundwater model results

i Mine inflow

Predicted inflow to the open cut during mining is presented on Figure 9.16. The inflow rate peaks in mining year 2 at 890 ML/yr and declines to 300 ML/yr by mining year 10. The predicted inflow peak corresponds to the indicative mine extraction schedule with the greatest volume of material excavated during mining years 2 to 4 (refer to Figure 2.6 in Section 2.6).

The predicted inflow rate does not equate to operational mine dewatering requirements. Evaporation from the pit walls and water entrained within the mined ore and waste material significantly reduce the requirement for dewatering. Annual evaporation from the open cut mine has been calculated to range from 29 ML (year 1) to 269 ML (year 10) and is factored in the project water balance (Appendix J).

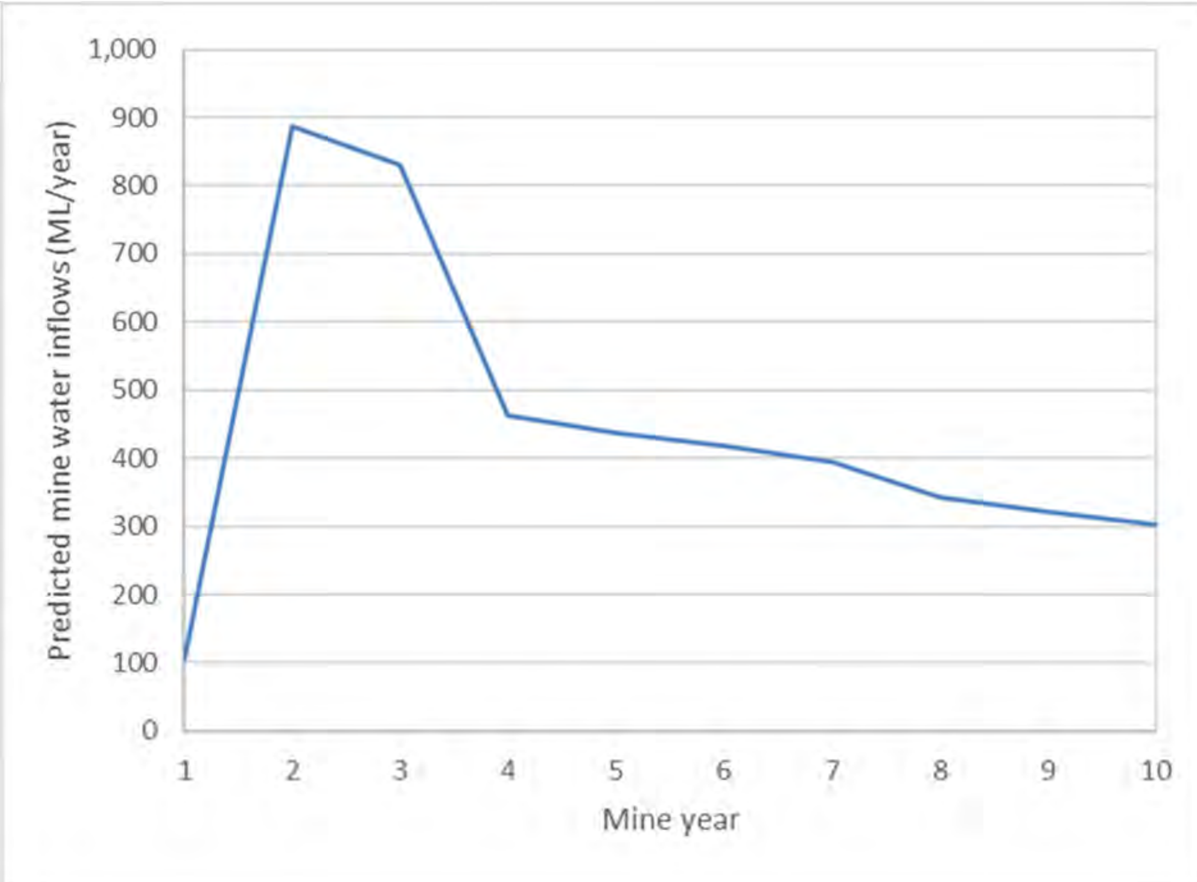
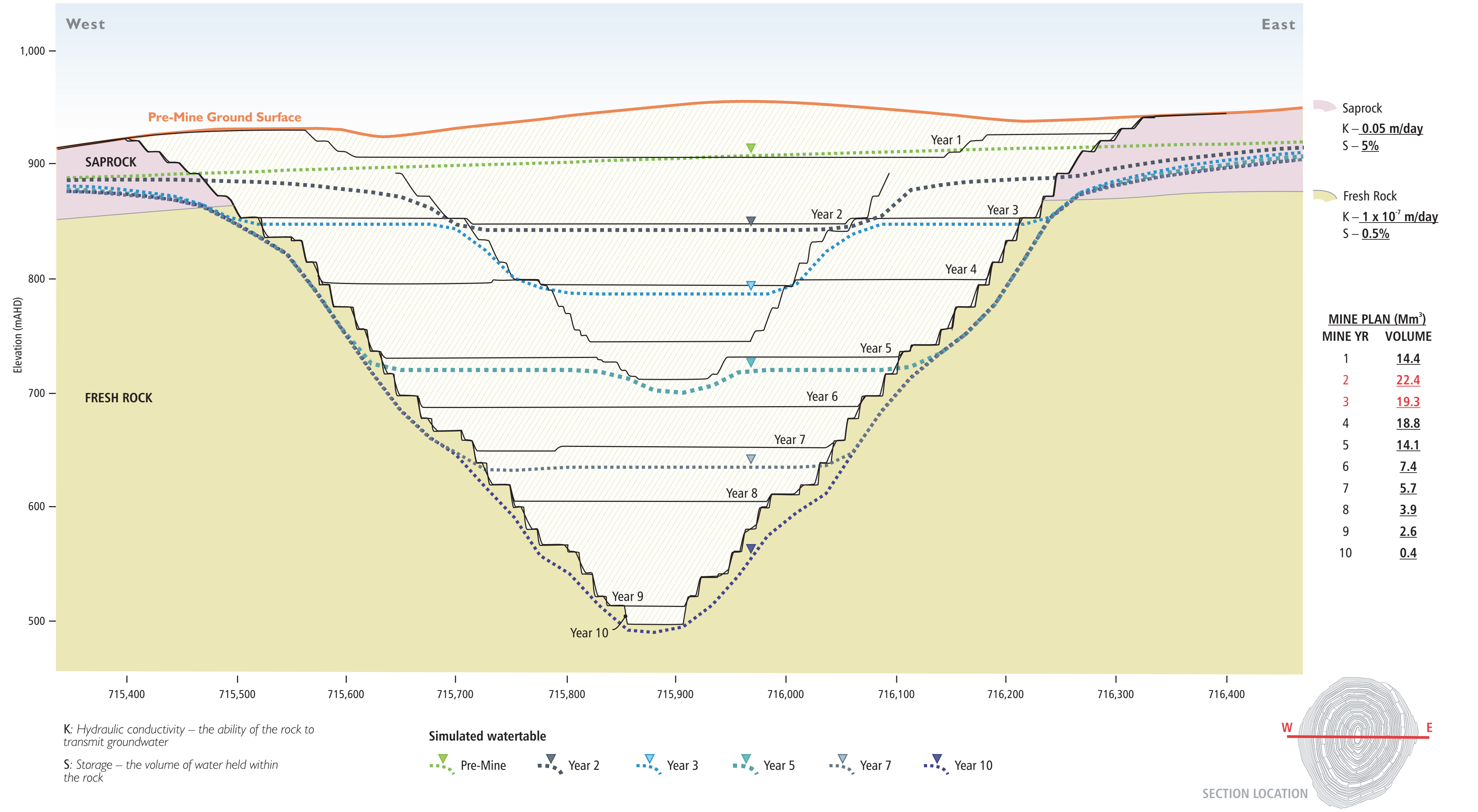


Figure 9.16 Predicted mine inflow rates

High inflow rates in mining years 2 and 3 are explained by the excavation of the saprock layer in mining year 2. The saprock stores and transmits more groundwater than the underlying fresh rock which is reflected in the groundwater model (relatively high specific yield and hydraulic conductivity). Post mining year 3 excavation is exclusively within the fresh rock and this is reflected in ongoing inflow rates (refer Figure 9.16).

As discussed in Section 9.4.2, uncertainty analysis has been conducted to better understand how the prediction results may vary due to inherent uncertainty within the system. The analysis includes assessing variability in hydraulic conductivity and storage parameters. Further discussion on uncertainty analysis is discussed in Section 9.5.1iii and Appendix K.



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Cross section through proposed open cut showing predicted drawdown

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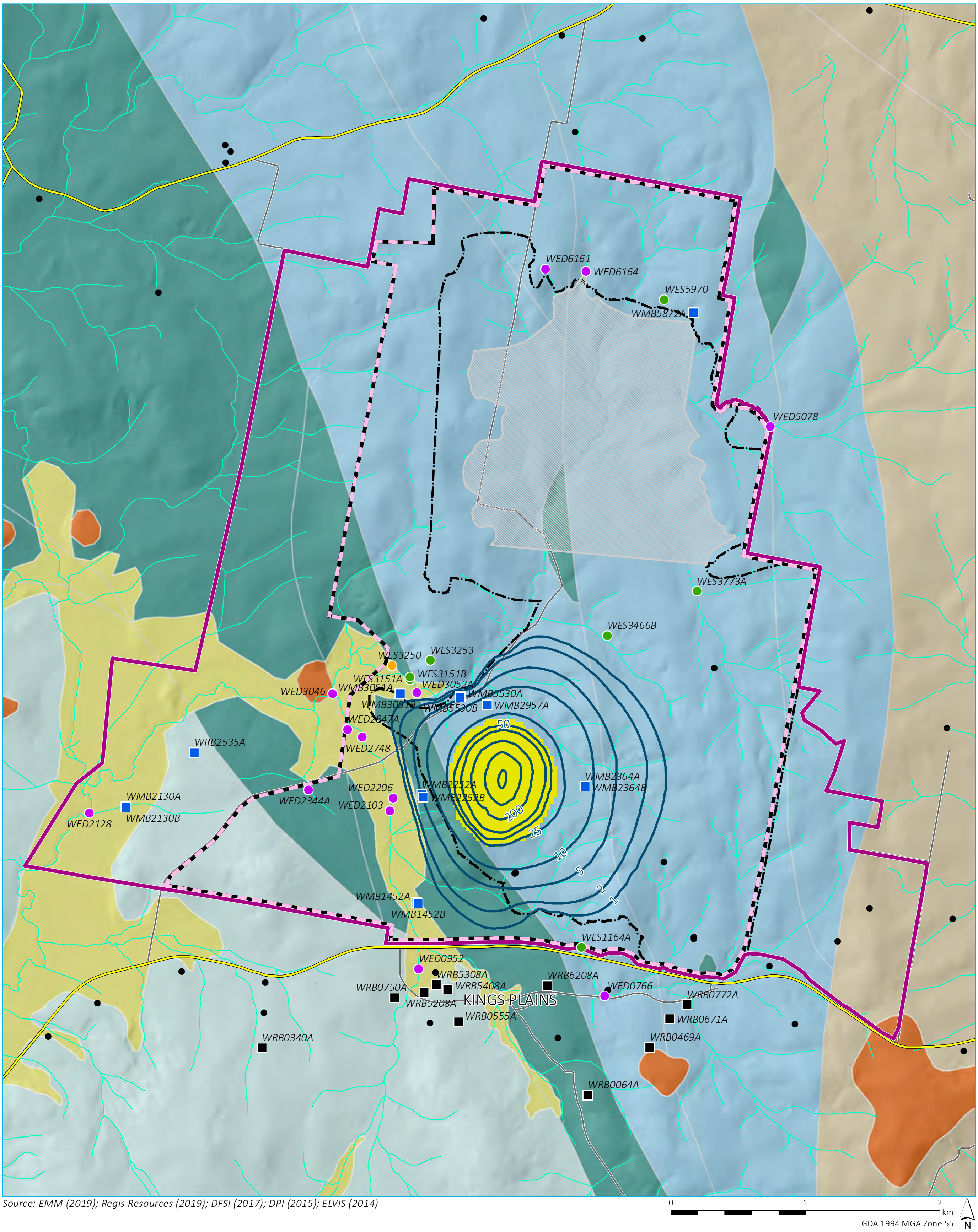
Figure 9.17

ii Groundwater levels

The predicted watertable drawdown at the end of mining (year 10) and 100 years post-mining is presented on Figure 9.18 and Figure 9.19. The predicted watertable elevation and groundwater flow direction at the end of mining and 100 years post-mining is also presented on Figure 9.20 and Figure 9.21. The groundwater model predicts:

- the extent of drawdown (defined by the 2 m contour, based on the AIP) will be greatest 100 years post-mining (Figure 9.18 and Figure 9.19);
- the existing natural high in the watertable north-east of the project is predicted to remain in place during mining and post-mining, confirming that project related impacts are not predicted to extend north and north-east of the project (Figure 9.20 and Figure 9.21);
- groundwater will continue to discharge to the Belubula River downstream of the mine development area during and post-mining Figure 9.20 and Figure 9.21);
- watertable drawdown will extend to Trib A and to the Belubula River upstream of the confluence with Trib A (Figure 9.18 and Figure 9.19);
- without mitigation, seepage from the TSF is predicted to flow south-west towards the Belubula River (west of the open cut mine area), however, the distance that the seepage will move over 100 years is not significant. Some of this seepage will flow towards the open cut mine, due to the hydraulic gradient caused by the watertable drawdown. Seepage will flow at a rate of around 50 m per 100 years; and
- watertable drawdown of 2 m or more is predicted to extend approximately 1.4 km to the east of the open cut mine by 100 years after mining ceases.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

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KEY

- PINEENA/Registered bore
- Groundwater monitoring site - Regis
- Groundwater monitoring site - other landholder
- Surface water monitoring site (dam)
- Surface water monitoring site (seepage area)
- Surface water monitoringsite (spring)
- Drawdown (m) (end of mining)

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

- Disturbance footprint
- TSF Stage 3 (961 mAHD)
- Simulated pit (year 10)

Existing environment

- Main road
- Local road
- Watercourse/drainage line

Geology (Bathurst 250k, 2nd Edition)

Quaternary / Tertiary

- Alluvium
- Tertiary basalt

Devonian

- Ungrouped Devonian Formations - Cunningham Formation

Silurian

- Mumbil Group (Northwest) - Anson Formation

Ordovician

- Cabonne Group - Blayney Volcanics
- Cabonne Group - Byng Volcanics

Predicted watertable drawdown (end of mining)

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Environmental impact statement
Figure 9.18

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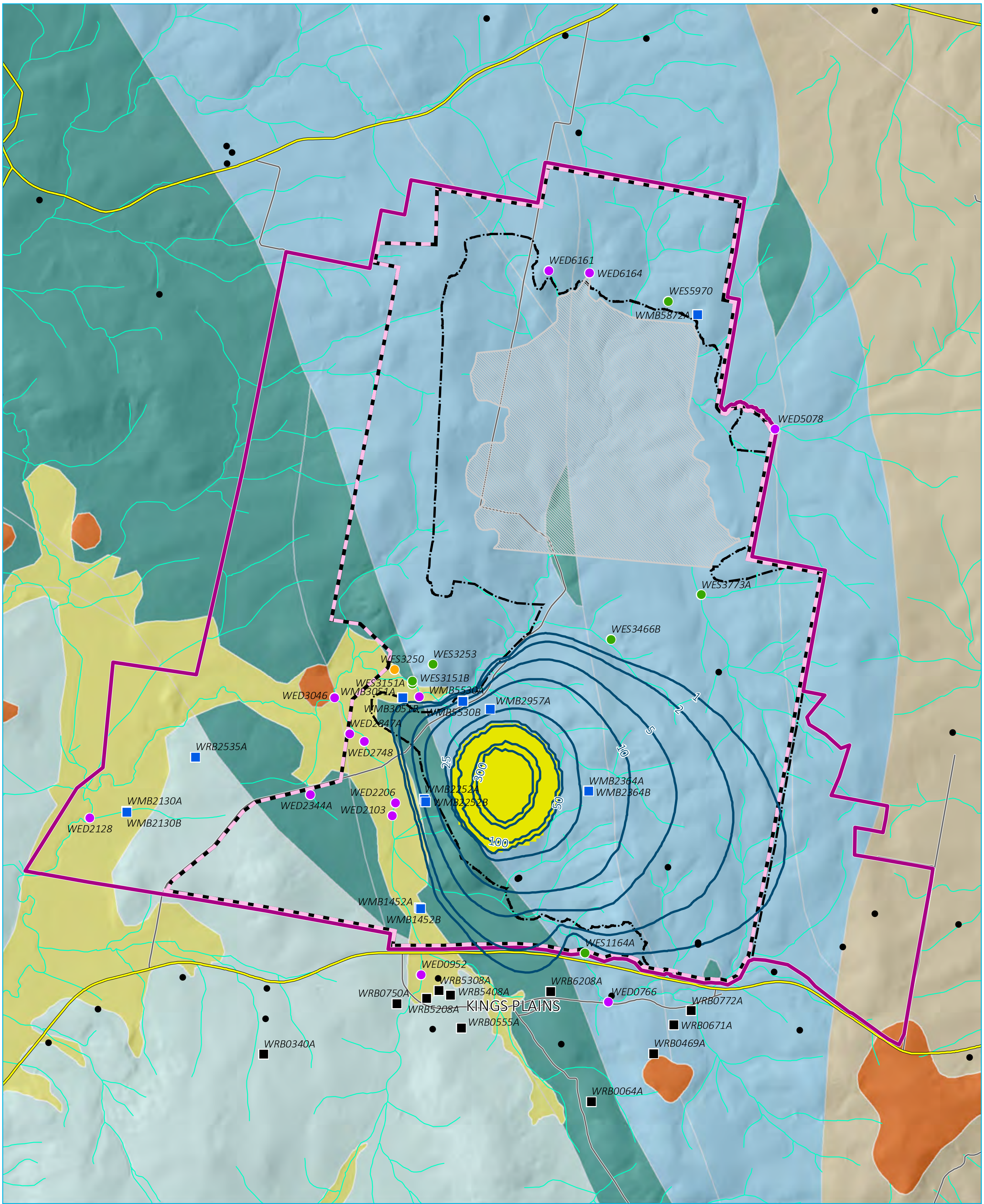

Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

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KEY

- PINEENA/Registered bore
- Groundwater monitoring site - Regis
- Groundwater monitoring site - other landholder
- Surface water monitoring site (dam)
- Surface water monitoring site (seepage area)
- Surface water monitoringsite (spring)
- Drawdown (m) (100 years after mining)

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

- Disturbance footprint
- TSF Stage 3 (961 mAHD)
- Simulated pit (year 10)

Existing environment

- Main road
- Local road
- Watercourse/drainage line

Geology (Bathurst 250k, 2nd Edition)

Quaternary / Tertiary

- Alluvium
- Tertiary basalt

Devonian

- Ungrouped Devonian Formations - Cunningham Formation

Silurian

- Mumbil Group (Northwest) - Anson Formation

Ordovician

- Cabonne Group - Blayney Volcanics
- Cabonne Group - Byng Volcanics

Predicted watertable drawdown (100 years after mining)

McPhillamys Gold Project
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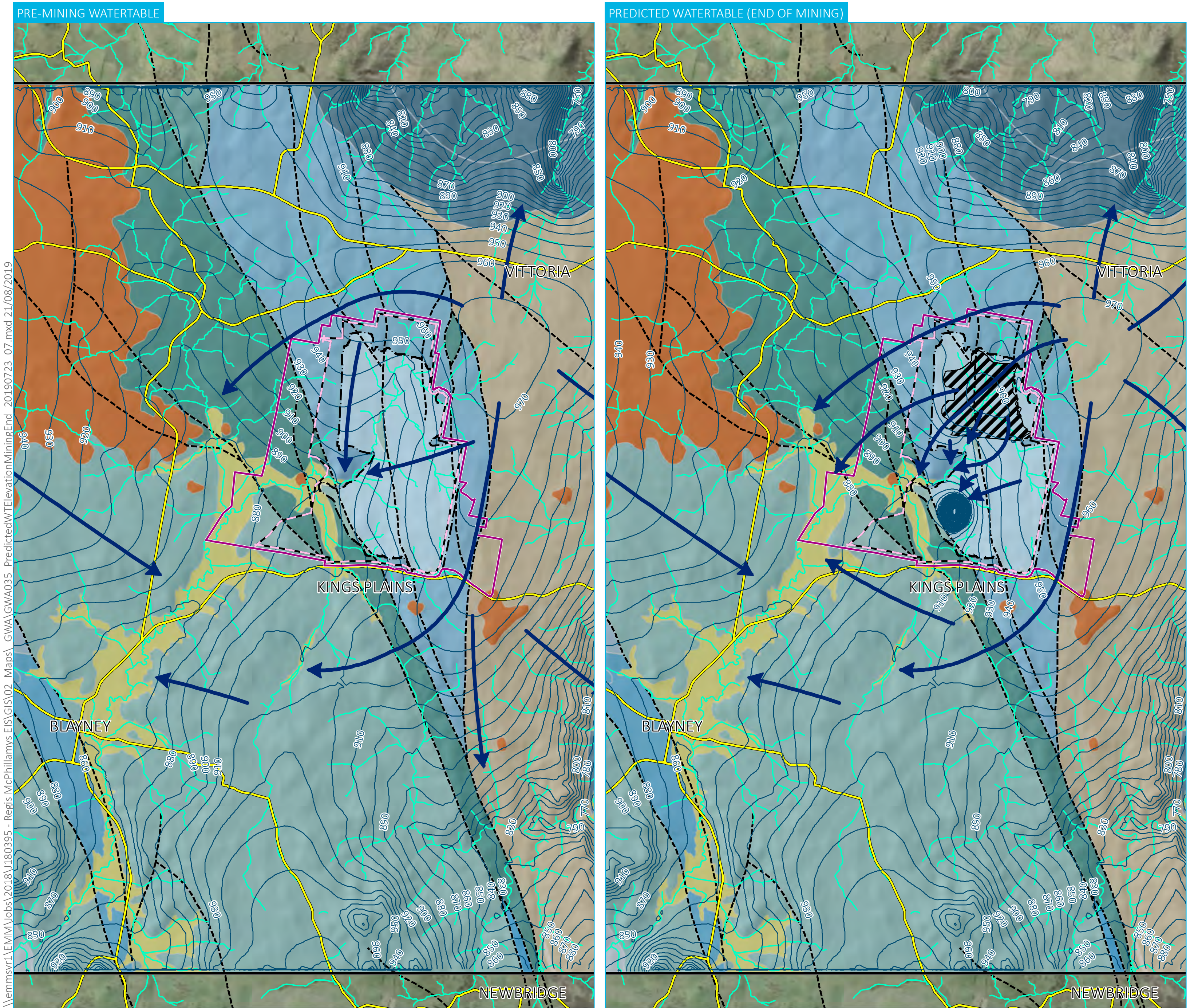
Figure 9.19



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Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

KEY

- Model boundary
- Watertable elevation contour (mAHD)
- Groundwater flow direction
- Watercourse/drainage line

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Tailings storage facility

Geology (Bathurst 250k, 2nd Edition)

- Fault

Quaternary / Tertiary

- Alluvium
- Tertiary basalt
- Trachyte

Carboniferous

- Bathurst Batholith - Gresham Granite
- Bathurst Batholith - Icely Granite

Devonian

- Other Carboniferous Intrusions
- Ungrouped Devonian Formations - Cunningham Formation
- Crudine Group - Bushranger Volcanics
- Crudine Group - Waterbeach Formation

Silurian

- Other Silurian Intrusions - Carcoar Granodiorite
- Other Silurian Intrusions
- Mumbil Group (Northwest) - Anson Formation
- Mumbil Group (Northwest) - Wombiana Formation
- Mumbil Group (East) - Campbells Formation

Ordovician

- Ordovician Intrusions
- Cabonne Group - Blayney Volcanics
- Cabonne Group - Oakdale Formation
- Cabonne Group - Byng Volcanics

Other

- Lake

Predicted watertable elevation and groundwater flow direction (end of mining)

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Environmental impact statement
Figure 9.20

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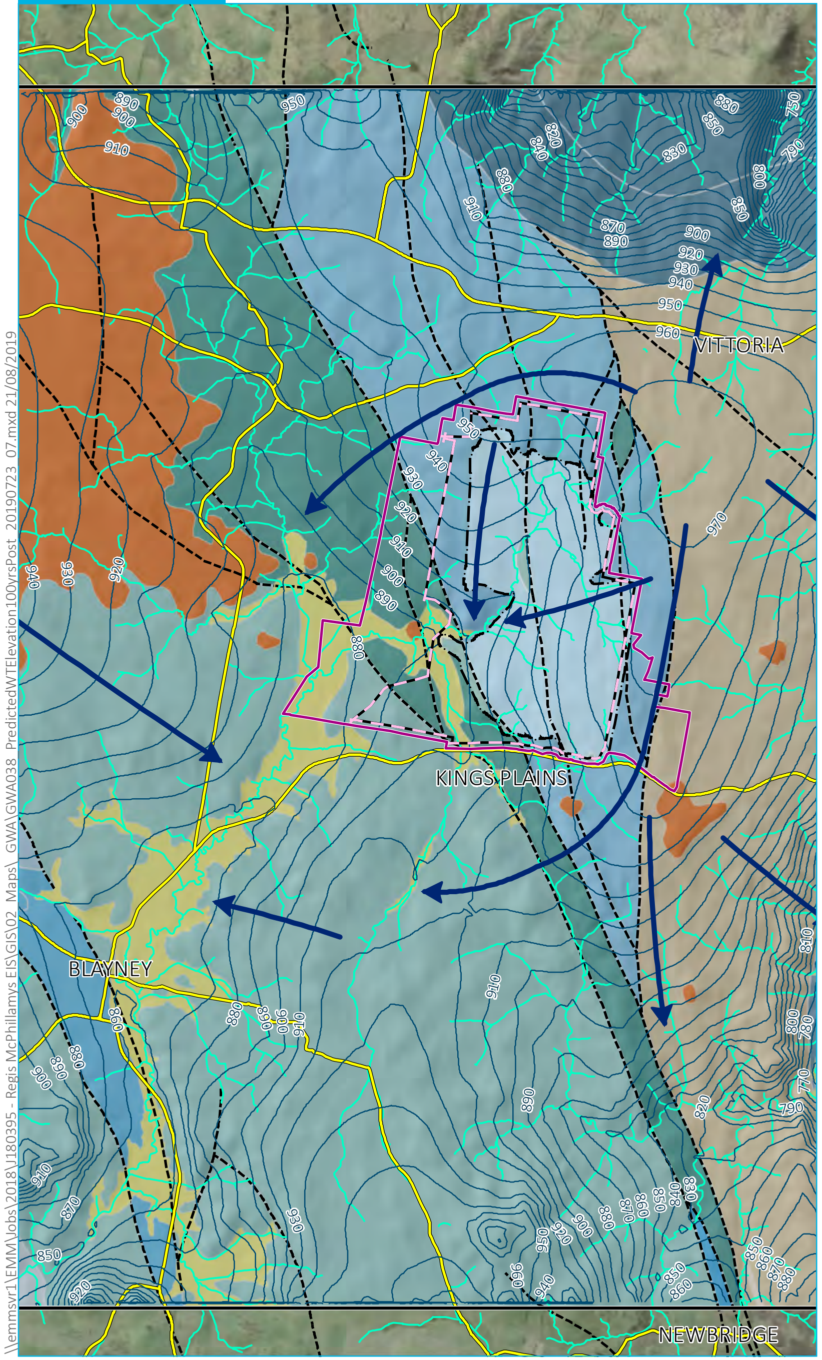
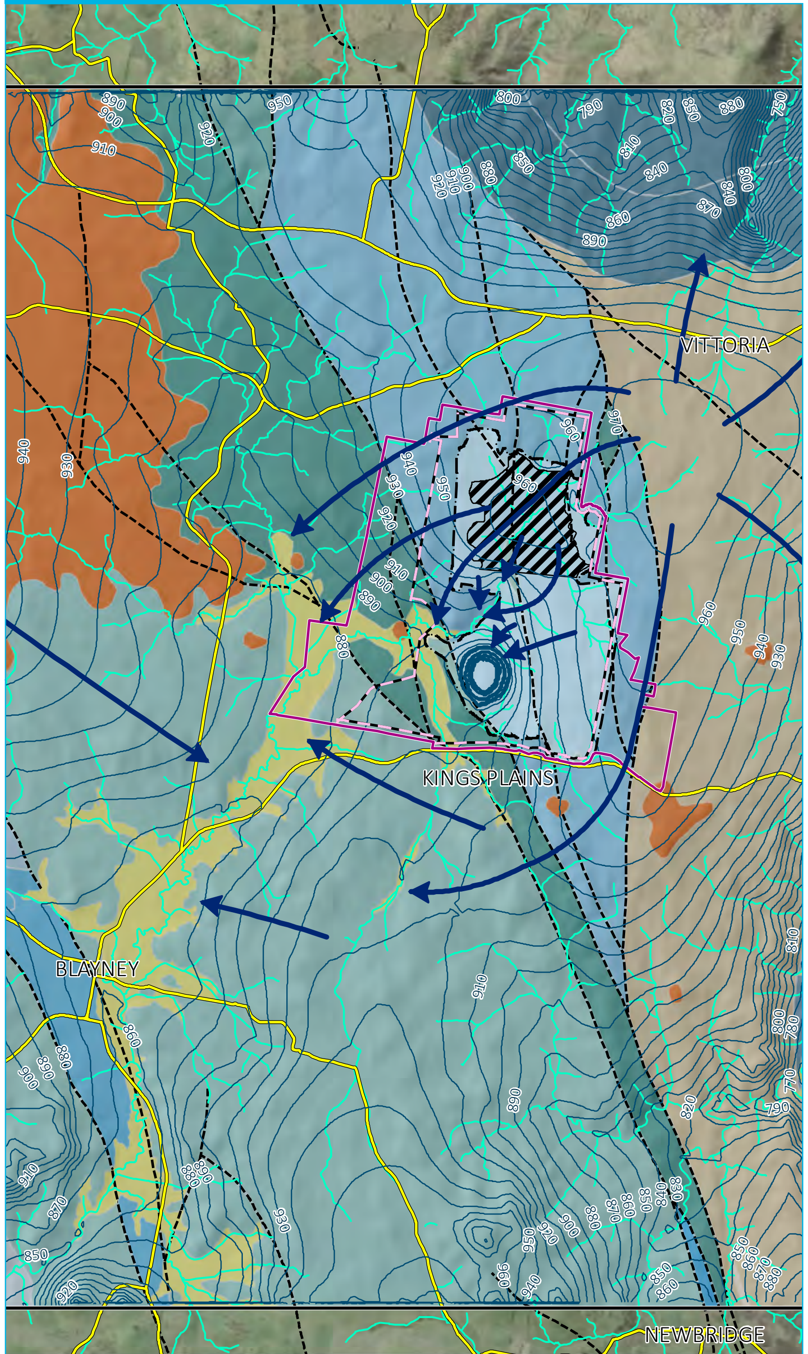
EMM creating opportunities

PRE-MINING WATERTABLE



PREDICTED WATERTABLE (100 YEARS AFTER MINING)



KEY

- Model boundary
- Watertable elevation contour (mAHD)
- Groundwater flow direction
- Watercourse/drainage line

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Tailings storage facility

Geology (Bathurst 250k, 2nd Edition)

- Fault

Quaternary / Tertiary

- Alluvium
- Tertiary basalt
- Trachyte

Carboniferous

- Bathurst Batholith - Gresham Granite
- Bathurst Batholith - Icely Granite

Devonian

- Other Carboniferous Intrusions
- Ungrouped Devonian Formations - Cunningham Formation
- Crudine Group - Bushranger Volcanics
- Crudine Group - Waterbeach Formation

Silurian

- Other Silurian Intrusions - Carcoar Granodiorite
- Other Silurian Intrusions
- Mumbil Group (Northwest) - Anson Formation
- Mumbil Group (Northwest) - Wombiana Formation
- Mumbil Group (East) - Campbells Formation

Ordovician

- Ordovician Intrusions
- Cabonne Group - Blayney Volcanics
- Cabonne Group - Oakdale Formation
- Cabonne Group - Byng Volcanics

Other

- Lake

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Predicted watertable elevation and groundwater flow direction (100 years after mining)

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Figure 9.21

\\emmsvr1\EMM\Jobs\2018\J180395 - Regis McPhillamys EIS\GIS\02_Maps_GWA\GWA038_PredictedWTElevation100yrsPost_20190723_07.mxd 21/08/2019

a Groundwater levels at third party bores

The base case model predictions indicate that groundwater levels at existing third party bores will experience little to no change as a result of the project (refer Figure 9.21). The AIP identifies thresholds for impact considerations and defines a cumulative pressure head decline of less than 2 m (at any water supply work) is defined as 'minimal impact'. As such, the assessed potential change in groundwater level do not trigger the AIP impact criteria for make good requirements.

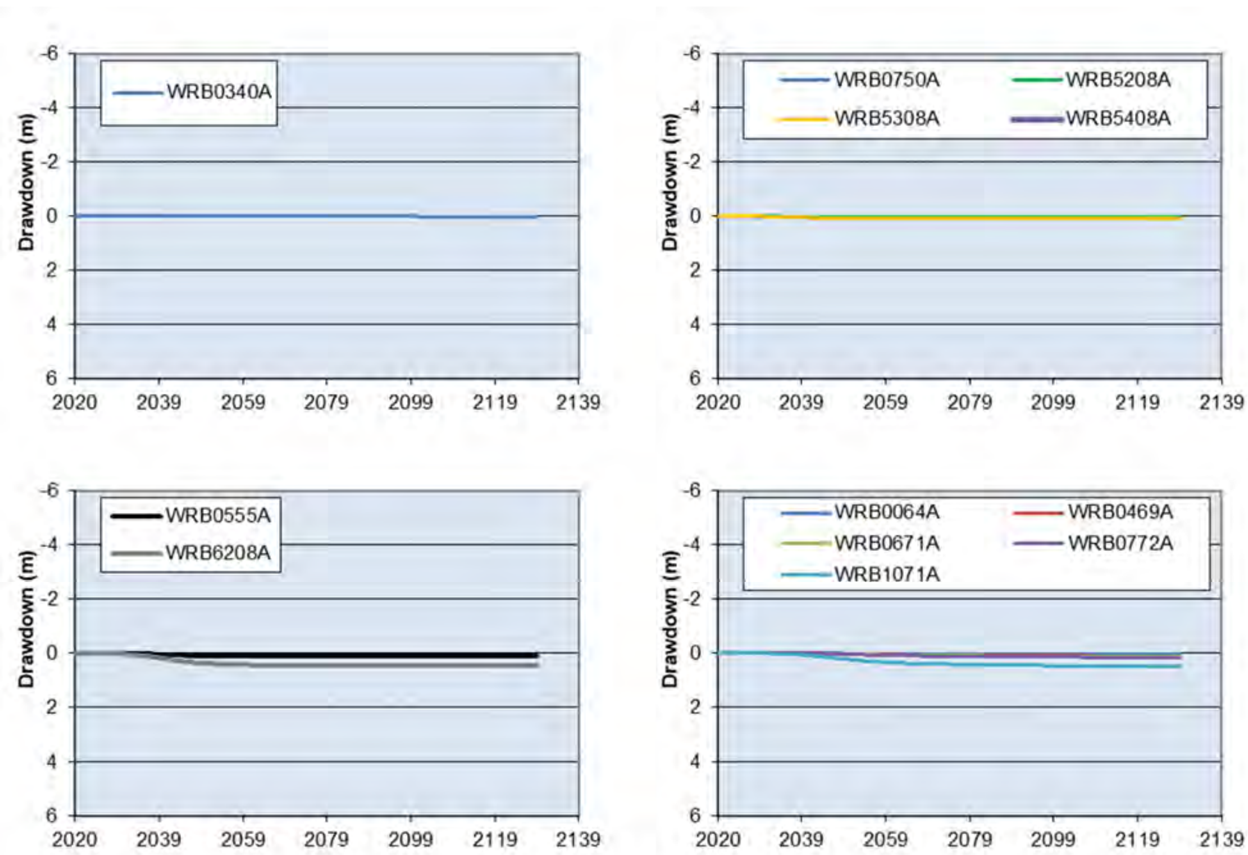


Figure 9.22 Predicted drawdown at third party bores (south and east of the pit area)

b Groundwater dependent ecosystems

The Mountain Gum – Manna Gum open forest of the South Eastern Highlands Bioregion (PCT 951) was identified to be episodically reliant on groundwater (refer Section 9.2.5).

The watertable is predicted to decline as a result of mining in areas where PCT 951 has been identified (Appendix K). The trees at risk of being impacted are located on the edge of the disturbance boundary, in the pit area. These trees are expected to have reduced access to groundwater during periods of low rainfall when soil moisture is low.

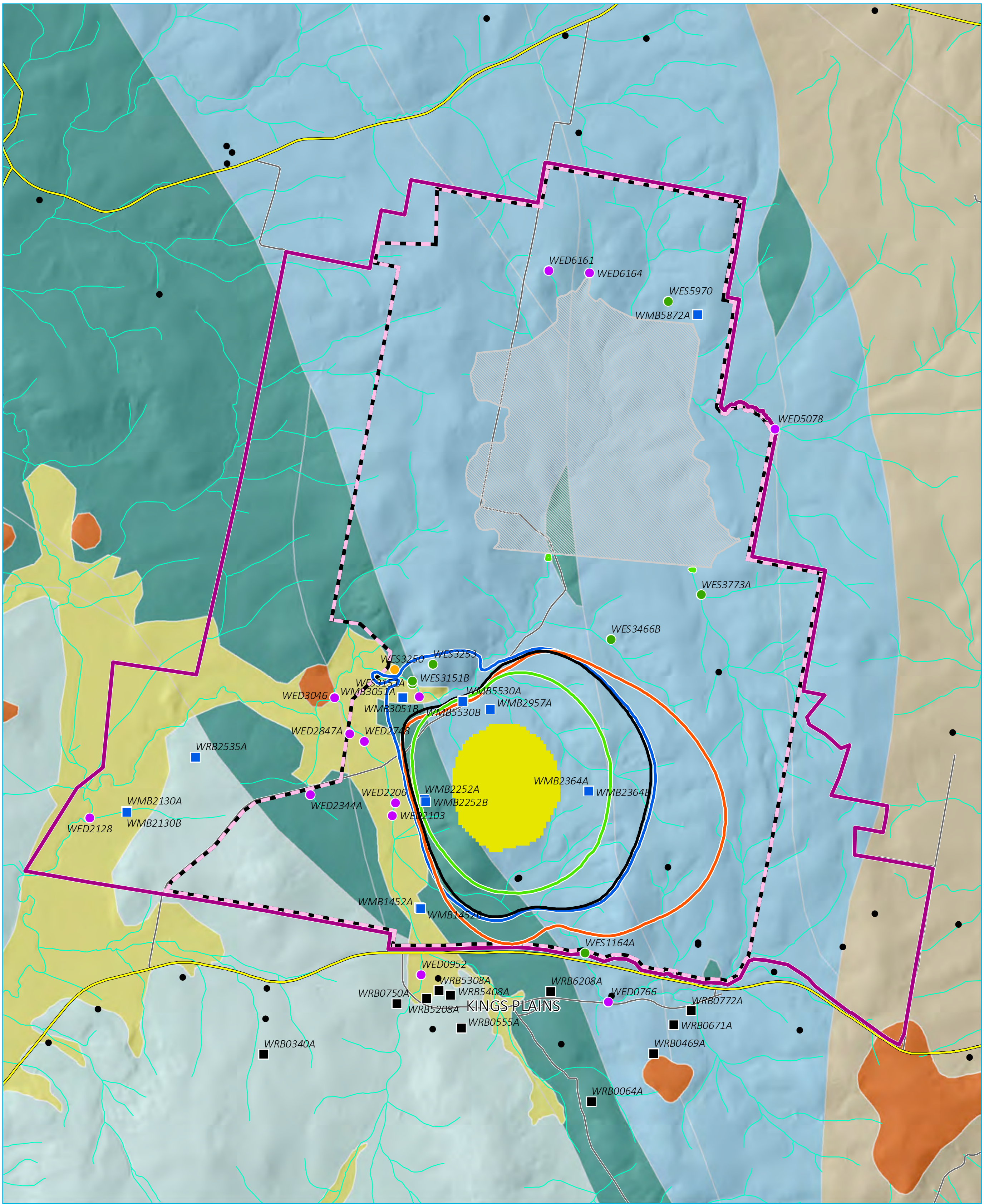
Closer to the Belubula River, north of the pit, where other PCT 951 trees are mapped, the depth to water is predicted to remain <20 mbgl (from end of mining to 100 years after mining). The PCT 951 vegetation in this area are not predicted to be affected by the project.

Surveys conducted identified two springs that contained fauna that are inferred to be groundwater dependent. These springs are located away from the open cut mine but are within the project disturbance area. No stygofauna were identified in bores in the project area.

iii Uncertainty results

A total of 63 uncertainty scenarios have been simulated. This section provides a summary of the uncertainty analysis, with a focus on the 'best case' and 'worst case' uncertainty models (defined by extent of drawdown). Appendix K details the results of the uncertainty analysis. The predicted 2 m drawdown contour at the end of mining (year 10) for the 'best case' and 'worst case' is presented, along with the base case model results and the dry watercourse scenario, on Figure 9.23. The results at 100 years after mining are shown on Figure 9.24.

- The results show the greatest difference in predicted drawdown between the uncertainty scenarios and the base case occurs at the end of mining.
- The base case and 'worst case' scenario have a similar drawdown extents by 100 years after mining (Figure 9.24).
- The extent of drawdown in the 'best case' scenario is significantly less than the base case and 'worst case' scenarios.
- The predicted 2 m drawdown contour for the dry watercourse uncertainty scenario at the end of mining and 100 years after mining is predicted to extend further to the north and across the Belubula River (relative to the base case model predictions).
- The results of the uncertainty analysis show that even in the 'worst case' drawdown scenario, it is unlikely that existing third party bores will experience groundwater level drawdown greater than 2 m (Figure 9.23 and Figure 9.24).
- With respect to potential GDEs, the trees that are predicted to be affected are located on the edge of the disturbance boundary, in the open cut mine area. Closer to the Belubula River, north of the open cut mine, where other PCT 951 trees are mapped, the depth to water is predicted to remain < 20 mbgl under these uncertainty scenarios (refer to Appendix K). Therefore, the model results suggest that PCT 951 vegetation in the area north of the open cut is unlikely to be affected by the project.
- Under the dry watercourse scenario, the depth to water is predicted to range from 10-20 mbgl to > 20 mbgl in the area north of the open cut mine where PCT 951 vegetation has been mapped (refer Figure 6.22 of Appendix K). Under this scenario, there is the potential for PCT 951 vegetation in this area to have reduced access to groundwater during periods of low rainfall.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

N

KEY

- Best case 2 m drawdown
- Base case 2 m drawdown
- Worst case 2 m drawdown
- Dry watercourse scenario 2 m drawdown
- PINEENA/Registered bore
- Groundwater monitoring site - Regis
- Groundwater monitoring site - other landholder
- Surface water monitoring site (dam)
- Surface water monitoring site (seepage area)
- Surface water monitoringsite (spring)

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- TSF Stage 3 (961 mAHD)
- Simulated pit (year 10)

Existing environment

- Main road
- Local road
- Watercourse/drainage line

Geology (Bathurst 250k, 2nd Edition)

Quaternary / Tertiary

- Alluvium
- Tertiary basalt

Devonian

- Ungrouped Devonian Formations - Cunningham Formation

Silurian

- Mumbil Group (Northwest) - Anson Formation

Ordovician

- Cabonne Group - Blayney Volcanics
- Cabonne Group - Byng Volcanics

Uncertainty analysis predicted 2 m drawdown at end of mining

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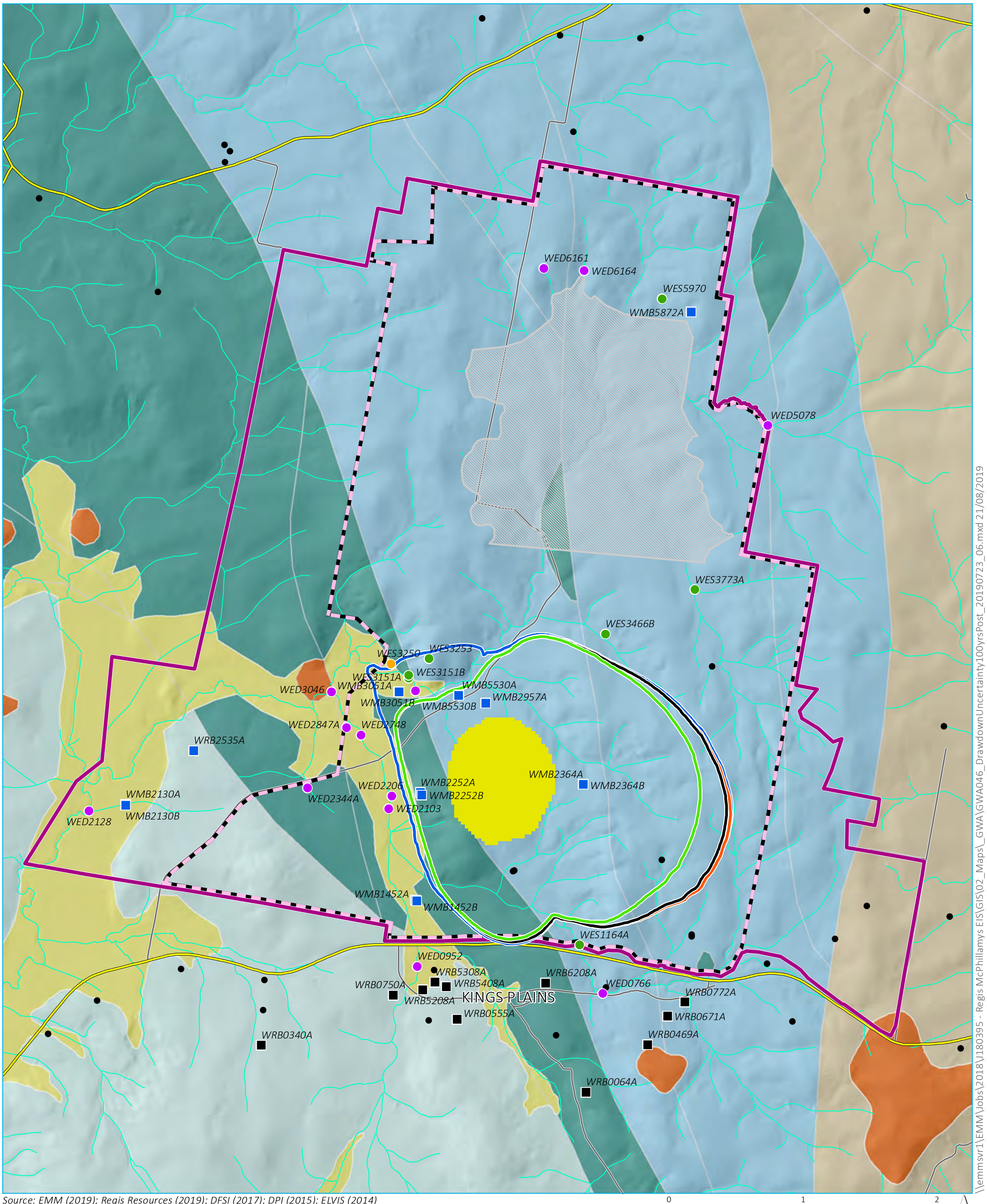
Figure 9.23



Source: EMM (2019); Regis Resources (2019); DFSI (2017); DPI (2015); ELVIS (2014)

KEY

- Best case 2 m drawdown
- Base case 2 m drawdown
- Worst case 2 m drawdown
- Dry watercourse scenario 2 m drawdown
- PINEENA/Registered bore
- Groundwater monitoring site - Regis
- Groundwater monitoring site - other landholder
- Surface water monitoring site (dam)
- Surface water monitoring site (seepage area)
- Surface water monitoringsite (spring)

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- TSF Stage 3 (961 mAHD)
- Simulated pit (year 10)

Existing environment

- Main road
- Local road
- Watercourse/drainage line

Geology (Bathurst 250k, 2nd Edition)

Quaternary / Tertiary

- Alluvium
- Tertiary basalt

Devonian

- Ungrouped Devonian Formations - Cunningham Formation

Silurian

- Mumbil Group (Northwest) - Anson Formation

Ordovician

- Cabonne Group - Blayney Volcanics
- Cabonne Group - Byng Volcanics

Uncertainty analysis predicted 2 m drawdown 100 years after mining

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Environmental impact statement
Figure 9.24

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9.5.2 Pit lake recovery

As mentioned in Section 9.4.1ii, predicted groundwater flux and groundwater elevation post-mining was provided for use in the post-mine water balance to assess pit lake recovery in the Surface Water Assessment (Appendix J). The final void water balance predicts the pit lake will recover to an elevation of around 902 mAHD. The pit lake is predicted to take around 400 years to reach this elevation.

The results of the final void water balance model predict that the pit lake level will remain below ground surface and no spills occur.

Water balance information from the final void balance has been used in the groundwater model to assess the long-term impacts of the project on the regional groundwater system and to provide comparison to the final void water balance (refer Appendix K). The predicted post-mining pseudo steady state groundwater elevation is consistent with the results of the final void water balance.

Under predicted long-term steady state conditions, the pit lake remains predominantly a sink even after 400 years. Following approximately 400 years, equilibrium is predicted to be reached and inflow to the void is predicted to remain the primary flow path of water (approximately 97%) in the vicinity of the open cut and a very minor volume (approximately 3%) is predicted to slowly seep back into the groundwater resources within close proximity of the open cut.

9.5.3 Changes to surface water - groundwater interactions

Watertable drawdown has the potential to reduce baseflow to and increase leakage from the local watercourses; this was assessed as part of the groundwater model predictions.

The following points summarise the results presented in Table 9.8:

- leakage from the Belubula River upstream of the confluence with Trib A is predicted to increase by up to 42 kL/day, which represents a 12% increase (when compared to a 'Null' (no mining) scenario);
- leakage from Trib A is predicted to increase by up to 44 kL/day, which represents a 5% increase (when compared to the 'Null' scenario);
- there is no predicted change in river leakage from or baseflow to the Belubula River downstream of Trib A;
- the greatest change in baseflow is predicted to occur to the Belubula River upstream of the confluence with Trib A (to the TSF embankment). Baseflow is predicted to reduce by up to 29 kL/day 100 years post-mining and represents a 15% reduction in baseflow (when compared to the 'Null' scenario); and
- baseflow to Trib A is predicted to reduce by up to 14 kL/day 6-100 years post-mining, which represents a 14% reduction in baseflow (when compared to the 'Null' scenario).

As mentioned in Section 9.2.4, groundwater is predicted to currently contribute approximately 5% of overall surface flows in the Belubula River upstream of the confluence with Trib A (under average climate conditions). Therefore, the predicted reduction in baseflow is expected to have a minor influence on overall surface flows in Trib A and the Belubula River upstream of the confluence with Trib A. As there is no predicted change in baseflow to the Belubula River downstream of Trib A, the groundwater discharge in these downstream areas is predicted to remain unchanged at around 300 kL/day between Trib A and Trib K and around 400 kL/day between Trib K and the Mid-Western Highway (refer Figure 9.3 for locations).

Table 9.8 Predicted changes in baseflow to and leakage from Trib A and the Belubula River

Mine Year	Belubula River upstream of Trib A confluence (kL/day)		Belubula River downstream of Trib A confluence (kL/day)		Trib A (kL/day)	
	Baseflow [1]	Leakage [2]	Baseflow [1]	Leakage [2]	Baseflow [1]	Leakage [2]
During mining						
1	0	0	0	0	0	0
2	-4	2	0	0	0	2
3	-14	10	0	0	-3	10
4	-19	19	0	0	-6	19
5	-23	24	0	0	-8	24
6	-25	28	0	0	-9	29
7	-27	29	0	0	-10	31
8	-28	30	0	0	-11	33
9	-28	30	0	0	-11	34
10	-29	30	0	0	-11	35
Post-mining						
+1	-22	32	0	0	-12	36
+2	-23	36	0	0	-12	37
+3	-24	38	0	0	-13	39
+4	-25	40	0	0	-13	40
+5	-26	41	0	0	-13	41
+6	-26	42	0	0	-14	41
+7	-26	42	0	0	-14	42
+8	-27	42	0	0	-14	42
+9	-27	42	0	0	-14	42
+10	-27	42	0	0	-14	43
+50	-28	42	0	0	-14	44
+100	-29	42	0	0	-14	44

Notes: 1. A negative number indicates baseflow (groundwater discharge to the watercourse) is predicted to reduce as a result of the project, when compared to the null (no mining) scenario.
2. A positive number indicates river leakage (to groundwater) is predicted to increase as a result of the project (ie leakage is greater in the mining scenario when compared to the null scenario).

The watertable at spring locations is predicted to decline less than 1 m or increase in elevation as a result of the project. At locations where the watertable is predicted to decline (eg WES1164A, where a decline less than 1 m is predicted) spring flows may reduce. Figure 9.25 presents predicted watertable drawdown or mounding at selected spring locations: north of the TSF (WES5970); between the TSF and the open cut mine, near the Belubula River (WES3253, WES3250, WES3151A and WES3151B); and south-east of the open cut mine (WES1164A). The model predicts:

- minor mounding of the watertable in the area between the TSF and the open cut mine, near the Belubula River (<2 m draw up);
- minor drawdown of the watertable at spring WES1164A south-east of the open cut mine (<1 m drawdown); and
- mounding of the watertable at spring WES5970 north of the TSF (<3 m draw up).

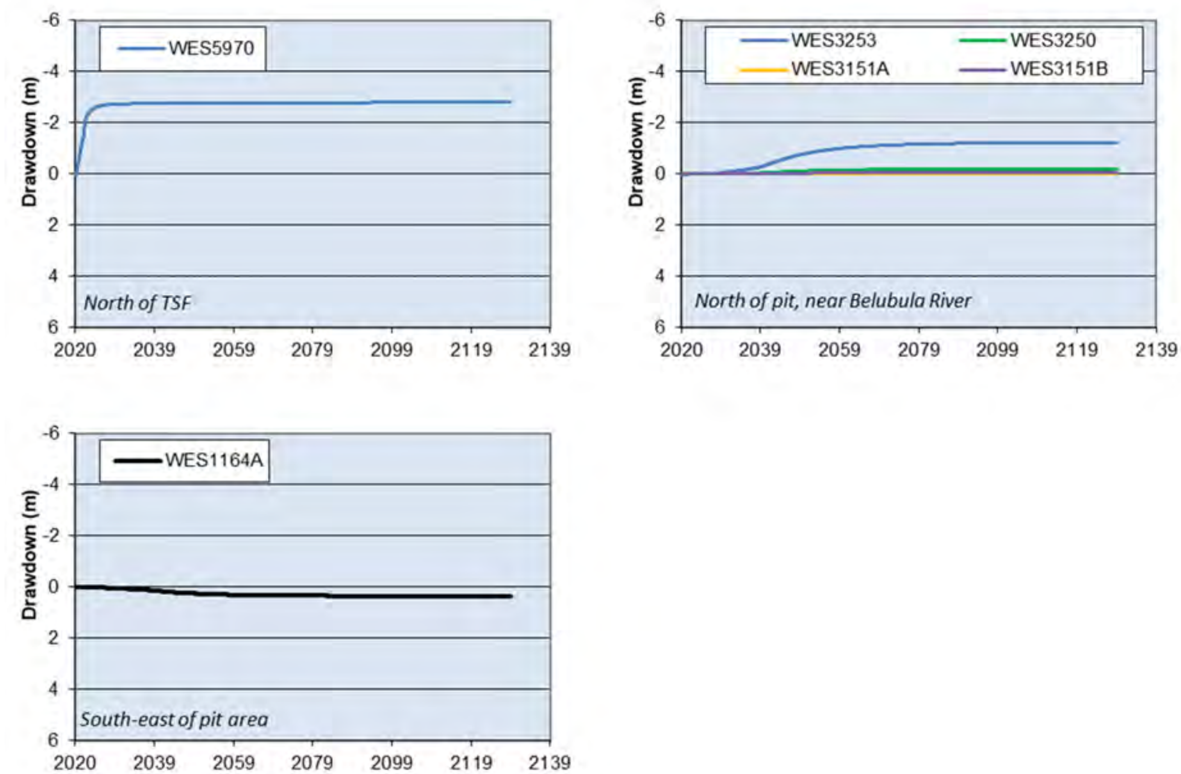


Figure 9.25 Predicted watertable drawdown at selected spring locations

Based on the assessments conducted, the main contribution to the Belubula River surface flows in the upper reaches comes from rainfall and surface water runoff, with minor contribution provided by the springs and regional groundwater system. The main change to the surface water flows will result from a reduction in the surface water catchment area, rather than construction of the TSF on the springs. Predicted changes to streamflow are discussed in Section 9.5.4 below.

Construction of the TSF over the springs and seeps will change the local flow system in the TSF area, removing the groundwater discharge at these locations. This groundwater resource will not be removed from the flow system. As flow gradients readjust, the groundwater will discharge at another location, which may be to a waterway or at another spring location.

9.5.4 Changes to streamflow

The natural flow regime of the Belubula River and tributaries is highly disturbed; the catchments have been extensively cleared for agriculture, and on-stream farm storage dams, which impede the natural flow, have been constructed along the length of the streams. The mine development has the potential to further impact on the flow regime of local streams due to:

- reduction in catchment area and runoff associated with the operational water management system for the mine; and
- interception of natural baseflow to streams associated with depressurisation of groundwater systems during mining and post-mining.

The predicted changes in surface water flow as a result of reduced catchment size is discussed below and presented in detail in Appendix J. The potential changes in surface water flow as a result of baseflow interception is discussed in Section 9.5.3. Details regarding the operational water management system are included in Chapter 2 and Figure 2.13.

The predicted change in streamflow to Carcoar Dam is summarised in Table 9.9. Under existing conditions, median annual inflows to Carcoar Dam are modelled to be 5,836 ML/yr or higher. Of the 5,836 ML/yr inflow to Carcoar Dam, 5,400 ML/yr originates from the catchments downstream of the mine development. Only around 440 ML/yr of the total flows to Carcoar Dam originate from the catchments within or upstream of the mine project area. During the operational phase, median annual inflows to Carcoar Dam are predicted to be reduced by 242 ML/yr (4.1%) due to a reduced catchment from the mine disturbance footprint (refer to Figure 9.26), when compared to the existing situation. During the post-closure phase, following mine rehabilitation, median annual inflows will be reduced by 28 ML/yr (0.47%) when compared to the existing situation. This level of change in streamflow is expected to be minor in comparison with the natural variability in catchment conditions.

Currently, annual inflows to Carcoar Dam are estimated to be at least 1,463 ML 95% of the time; that is, 95% of the time flows are predicted to be greater than 1,463 ML. The 95% value can be used to represent streamflow during low rainfall climatic conditions. At maximum disturbance, the mine development is predicted to reduce streamflow to Carcoar Dam during these low rainfall conditions by 61 ML/yr to 1,402 ML/yr (compared to existing conditions).

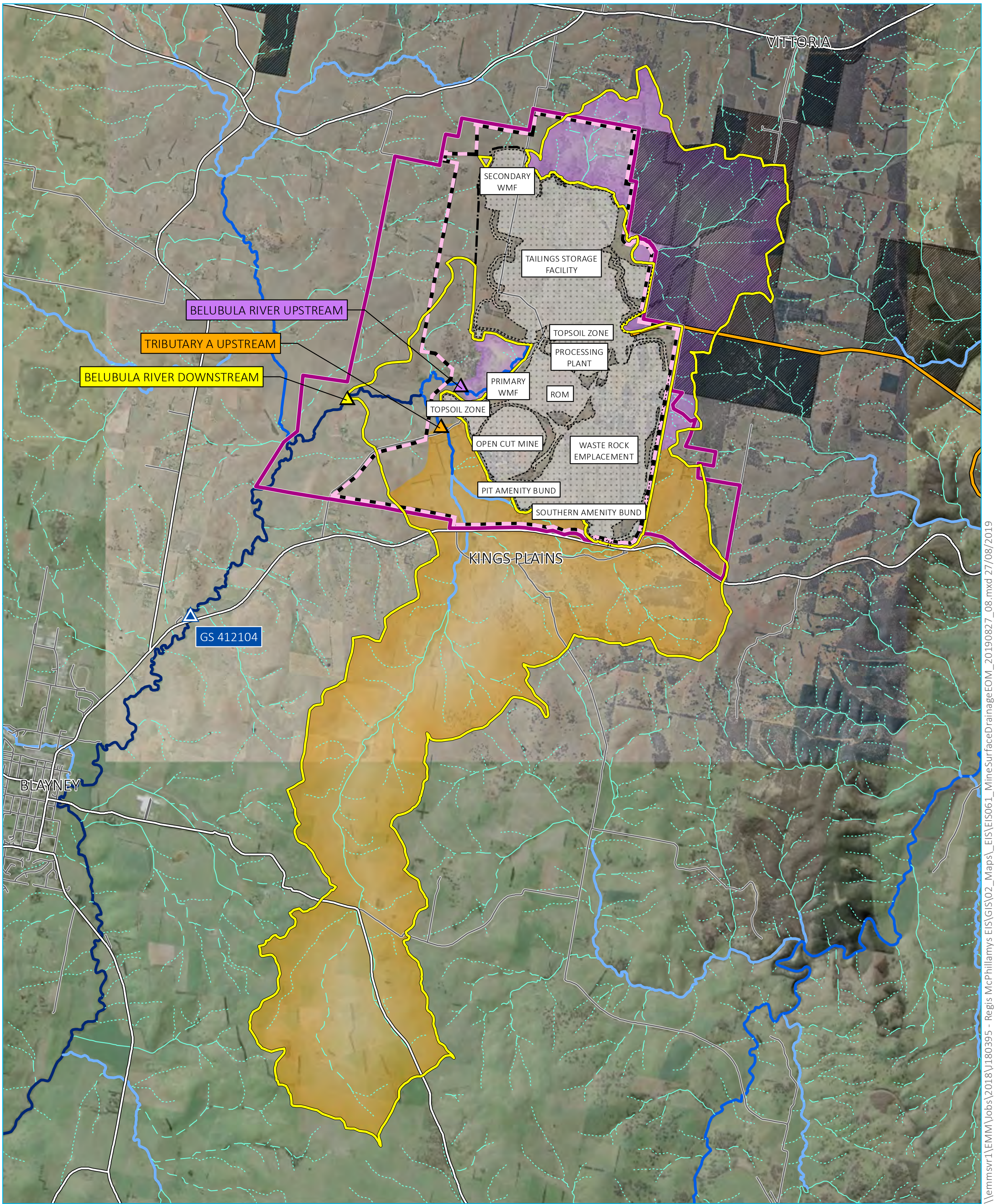
The changes to flow during the operational phase are predicted to be short-lived and peak at the time of maximum disturbance of the mine. The maximum catchment area captured by the mine development will be 964 ha (4.1% of the total Carcoar Dam catchment). In the long-term, following rehabilitation, the area removed from the Carcoar Dam catchment will be significantly smaller at 110 ha (ie the catchment of the final void – refer to Figure 9.27), resulting in smaller changes to flow downstream.

Table 9.9 Predicted change in streamflow to Carcoar Dam– operational and post-closure

Percentage of time flow is greater than the modelled inflow	Existing	Operational phase (at maximum disturbance)		Post-closure	
	Modelled inflow (ML/yr)	Modelled inflow (ML/yr)	Decrease in inflow (compared to existing inflow) (ML/yr)	Modelled inflow (ML/yr)	Decrease in inflow (compared to existing inflow) (ML/yr)
95%	1,463	1,402	61	1,456	7

Table 9.9 Predicted change in streamflow to Carcoar Dam– operational and post-closure

Percentage of time flow is greater than the modelled inflow	Existing	Operational phase (at maximum disturbance)		Post-closure	
	Modelled inflow (ML/yr)	Modelled inflow (ML/yr)	Decrease in inflow (compared to existing inflow) (ML/yr)	Modelled inflow (ML/yr)	Decrease in inflow (compared to existing inflow) (ML/yr)
90%	1,941	1,861	80	1,932	9
50%	5,836	5,594	242	5,809	28



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPI (2015); ELVIS (2014)

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Mine development general arrangement
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vittoria State Forest

- Existing stream gauging station

Proposed stream gauging station
- Belubula River Downstream
- Belubula River Upstream
- Tributary A Upstream

Undisturbed catchment area
- Area 1 (Belubula River Downstream) - 32.32 km²
- Area 2 (Belubula River Upstream) - 7.49 km²
- Area 3 (Trib A Upstream) - 22.23 km²

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Project area surface drainage - catchment reduction during mining

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Figure 9.26

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The percentage reduction of flow is larger higher up in the catchment. During the operational phase, the percentage reduction in median annual flow in the Belubula River at the Mid Western Highway (old gauging station 412104) is around 9%, and at the proposed Belubula Downstream gauging station (within the mine project area) median flows are estimated to reduce by approximately 22% (refer to Figure 9.3 for locations).

During low rainfall climatic conditions, streamflow within the Belubula River at the Mid Western Highway (ie just south of the mine project area boundary) is predicted to reduce by 60 ML/yr to 636 ML/yr (95% of the time flows will be higher, during the operational phase) when compared to existing conditions (refer Table 9.10). As discussed in Section 9.5.3, groundwater discharge as baseflow is predicted to remain unchanged in this area, supporting surface flows during periods of low rainfall. Groundwater discharge is predicted to remain at around 146 ML/yr in this area.

Table 9.10 Predicted change in streamflow at Mid Western Highway

Percentage of time flow is greater than the modelled inflow	Existing	Operational phase (at maximum disturbance)	
	Modelled inflow (ML/yr)	Modelled inflow (ML/yr)	Decrease in inflow (compared to existing inflow) (ML/yr)
95%	697	636	60 (8.6%)
90%	924	843	80 (8.7%)
50%	2,792	2,550	242 (8.7%)

Therefore, at maximum disturbance, flows in the Belubula River below the Mid Western Highway and above Carcoar Dam can be expected to range between at least 636 ML/yr and 1,402 ML/yr during periods of low rainfall. During these periods of low rainfall when downstream users are most reliant on water within the Belubula River, groundwater discharge as baseflow in the Mid Western Highway area is predicted to remain unchanged from current conditions.

To put this flow into context, the water requirements for the Belubula River above Carcoar Dam Water Source in accordance with the WSP for the Lachlan Unregulated and Alluvial Water Sources, are:

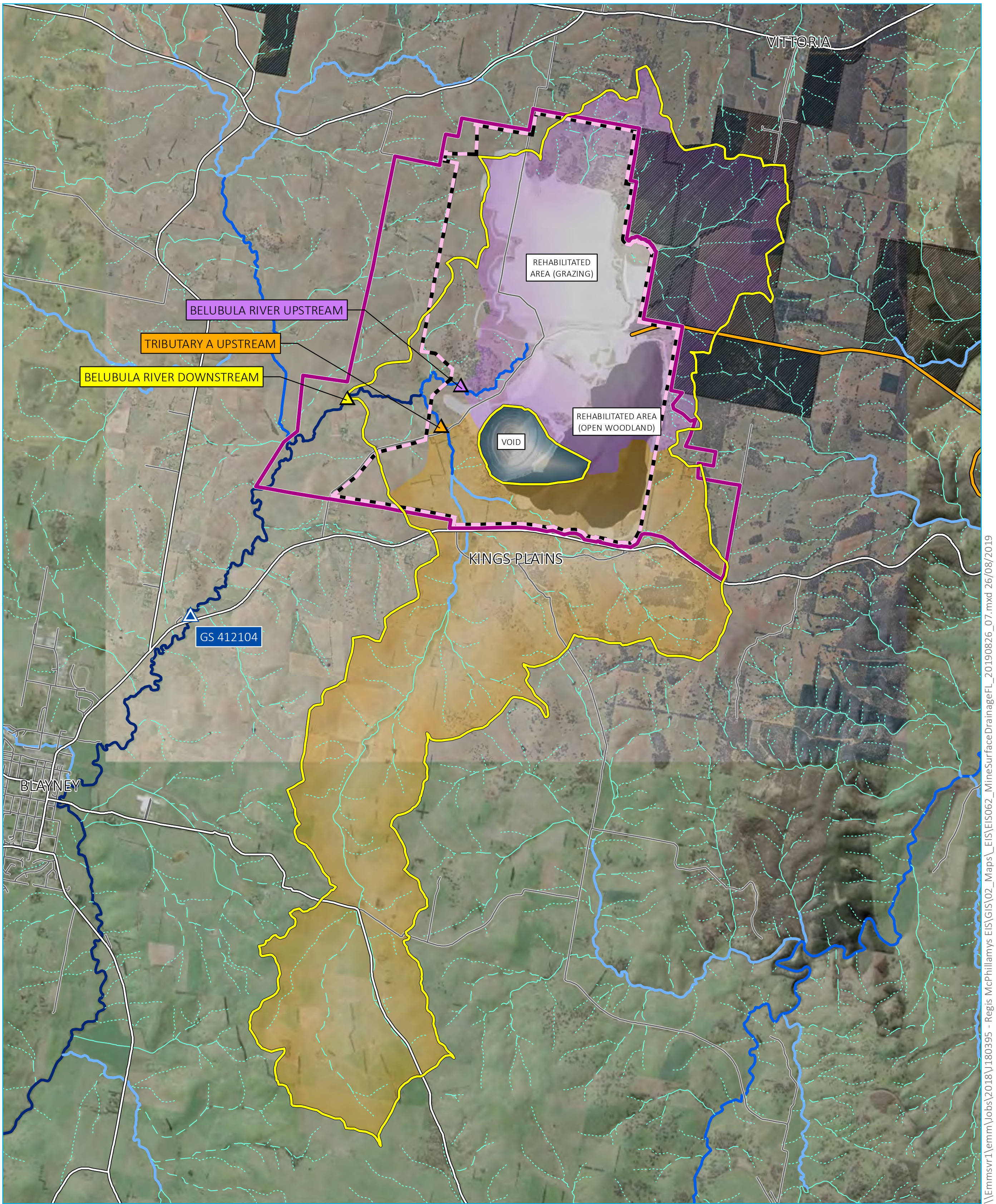
- domestic and stock rights: 68 ML/yr
- share components of domestic and stock access licences: 5 ML
- Total: 73 ML

In addition, there are three active WALs for the Belubula River above Carcoar Dam Water Source, with a combined allocation of 264 ML, as follows:

- 192 ML (WAL31475);
- 22 ML (WAL36818); and
- 50 ML (WAL31476).

There is therefore a total of 337 ML required/allocated for the Belubula River above Carcoar Dam Water Source. In the Belubula River between the mine project area and Carcoar Dam, modelled streamflow currently ranges from 697 ML/yr (at the Mid-Western Highway) to 1,436 ML/yr (at Carcoar Dam) in low rainfall conditions. Existing requirements are therefore well below streamflow in the river, even under low rainfall conditions. When the mine is at full disturbance, the reduced inflow to the Belubula River will be around 60 ML/yr.

Therefore, with the reduced flow as a result of the mine also accounted for, the flow in the river is modelled to be greater than the required/allocated water.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPI (2015); ELVIS (2014)

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor

Existing environment
- Main road
- Local road
- Vittoria State Forest
- Existing stream gauging station

Proposed stream gauging station
- Belubula River Downstream
- Belubula River Upstream
- Tributary A Upstream

Undisturbed catchment area
- Area 1 (Belubula River Downstream) - 42.39 km²
- Area 2 (Belubula River Upstream) - 15.71 km²
- Area 3 (Trib A Upstream) - 23.85 km²

Disturbed catchment area
- Void catchment area - 1.10 km²

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Project area surface drainage - catchment reduction post-mining

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Figure 9.27

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9.5.5 Changes to water quality

i Third party bores

With regard to the requirements of the AIP in relation to groundwater quality, it is not anticipated that the project activities will lower the beneficial use category of the groundwater source beyond 40 m from the mine development, provided the mitigation measures discussed in Section 9.7 are implemented. Cumulative changes to groundwater quality are not anticipated as a result of mining activities.

ii TSF seepage

The TSF is designed to avoid adverse impacts to the surrounding environment (ATC Williams 2019). It is large enough to contain all water from sustained rainfall events with minimal spill risk (Appendix J).

Without mitigation, seepage from the TSF is likely to be observed on the ground surface directly downstream from the embankment. Seepage may appear in depressions/hollows or discharge to the Belubula River downstream of the embankment.

The design and assessment of the TSF seepage management measures has been completed by ATC Williams (2019) (refer Appendix D). The primary purpose of the groundwater model is to assess the potential impacts of the TSF on the groundwater flow system. As such, the simulation of the TSF is deliberately conservative in the groundwater model.

The groundwater model predicts groundwater mounding during and post mining operations as a result of the tailings placement. Without effective management, seepage from the TSF is predicted to slowly migrate south-west and south of the TSF. Seepage from the TSF is predicted to remain within the saprock zone, flowing in a horizontal direction. Some of the seepage that migrates south from the TSF is not intercepted by the seepage management system and predicted to seep towards the pit. A percentage of the seepage is predicted to move towards the Belubula River at a rate of approximately 50 m in 100 years.

The liquid fraction results of tailings provide an indication of leachate concentrations in TSF seepage (SRK 2019). By the time TSF seepage migrates through the ground and reaches the Belubula River, the seepage water will mix with groundwater, and become diluted along the flow path and will undergo other hydrogeochemical reactions. The results of the groundwater assessment indicate that even without all seepage management measures in place, any seepage that may migrate through the HSU and discharge to the Belubula River will have concentrations below the observed baseline surface water quality concentrations, ANZECC (2000) livestock drinking water and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values (for analytes with elevated concentrations in the tailings liquid fraction results). This is discussed further in Appendix K.

Tailings deposition will use sub-aerial techniques, where tailings are deposited from multiple locations on the perimeter of the TSF. Water liberated during the deposition will be recovered for return to the process plant. The proposed tailings placement approach assists in reducing tailings permeability with time (ATC Williams 2019).

Following completion of mining and tailings placement, the TSF will be capped to facilitate surface water drainage, prevent any ponding of water and limit potential rainfall infiltration into the tailings (ATC Williams 2019).

The TSF design report (ATC Williams 2019) shows that the seepage interception trench is predicted to be highly effective at intercepting seepage from the TSF. The proposed seepage management measures described above and in Section 9.7 will play an important role in reducing the potential for TSF seepage migration and the potential impact on the groundwater quality and surface water quality and in turn any potential impacts on downstream users.

iii Seepage from stockpiles and water storages

Geochemical assessments have identified a portion of waste material as potentially acid forming (PAF) (refer to Appendix G). There is the potential for leachate from the waste rock emplacement to seep to the underlying watertable. However, the waste rock emplacement has been designed to ensure PAF materials are exposed for only short periods of time before being capped with compacted NAF materials. The encapsulated PAF waste cells will be monitored for changes in parameters such as oxygen, temperature and pH. In addition, as the emplacement will be undergoing compaction from heavy vehicle traffic, the risk of vertical migration of seepage will be low. Water storages capturing surface runoff from the waste rock emplacement will be positioned downstream and will be engineered to capture any seepage reporting to the toe of the emplacement for recirculation in the operational water management system.

Water storage ponds have the potential to seep water to the underlying watertable. As part of construction, the pond areas will be conditioned and bunded prior to construction to reduce water seepage. Water storage ponds have been designed to either not spill at all under all historical climate scenarios (the TSF and Secondary WMF) or have a less than 1% spill risk.

Applying the proposed management and monitoring measures (refer Section 9.7), the risk of leachate from the waste rock emplacement and water storages seeping to the watertable or migrating off site is unlikely.

iv External water supply via the pipeline

The project requires a reliable and sustainable water supply, primarily for the proposed processing plant and for dust suppression requirements. Initial hydrogeological investigations indicated that the likelihood of sourcing such a supply from local groundwater was low.

Water will therefore be supplied to the mine via the pipeline development, transferring surplus water from Centennial's Angus Place and SCSO, and MPPS near Lithgow, to the mine. The supply of water from Angus Place, SCSO and MPPS will enable a beneficial use of otherwise surplus water and provide a reliable water source for the project. At the end of mining, supply of water via the pipeline will cease.

The salinity of the water that will be brought in via the pipeline is expected to be fresh to brackish (up to 3,000 mg/L TDS) and within the range of existing baseline groundwater salinity. Baseline water quality monitoring conducted by Regis across the mine development area (at surface water and groundwater monitoring sites) shows groundwater salinity varies from fresh to brackish.

The project is designed to be a no discharge site, with water captured within the site contained and water brought into the site contained. The water management facilities will be engineered to minimise loss of water (as seepage) from these storages. As such, there is minimal risk that the water brought in via the pipeline will adversely impact the quality of groundwater or surface water.

v Reverse osmosis plant

The site will be equipped with an RO plant to meet the potable water demand of up to approximately 0.2 ML/day. The RO plant will be a self-contained portable unit and all brine produced by the RO plant will be contained within the site water management system and used in the process plant.

vi Final pit lake water quality

While the mine void acts as a groundwater sink, the salts and metals are expected to become concentrated with time due to evaporation and exposed PAF within the void. Under predicted long-term steady state conditions, the pit lake remains predominantly a sink even after 500 years.

Following approximately 500 years equilibrium is predicted to be reached and inflow to the void remains the primary flow path of water (approximately 97%) in the vicinity of the open cut and a very minor volume (approximately 3%) is predicted to slowly seep back into the groundwater resources within close proximity of the open cut. There is the potential for water within the pit lake to slowly migrate from the final void in the very long-term (greater than 500 years after mining).

The final void salt balance model predicts that the salinity of the pit lake will gradually increase due to evapo-concentration reaching around 1,700 mg/L TDS after 1,000 years, which is within the observed baseline groundwater salinity range (Appendix J).

9.5.6 Changes to flood regime

As noted in Section 9.4, the mine development will capture runoff from disturbed areas which will result in a reduction in catchment area reporting downstream hence the impact on flooding to downstream floodwaters would be a reduction in total and peak flow downstream of the mine development area.

As the project is in the headwaters of the catchment, localised flooding impacts would be confined to land owned by Regis. The proposed clean water diversion facilities are the most notable area where inundation of land will increase during the operational phase of the mine development, although only for short durations due to the adopted requirement to dewater the 1% AEP, 72 hour duration rainfall event in 10 days.

A summary of the results is included in the following sub-sections and also in Appendix J.

i Peak Flow Rates

Flow calculations for a range of design rainfall events (10%, 1%, 0.5%, 0.2%, 0.1% and probable maximum precipitation (PMP)) have been modelled using analytical calculations for a point adjacent to the proposed open cut.

A summary of the parameters that were used to obtain peak flows adjacent to the proposed open cut and the calculated peak flow rates are provided in Table 9.11.

Table 9.11 Summary of peak flow estimation adjacent to proposed open cut

Scenario	AEP	A (km^2)	t_c (min)	L (mm/h)	C	Diverted pump rate (m^3/sec)	Peak flow rate (m^3/sec)
Existing	10%	15.698	206	13.1	0.26	N/A	15.1
	1%			19.7	0.47		40.4
	0.5%			22.2	0.9		86.9
	0.2%			25.2	0.9		99.0
	0.1%			27.7	0.9		108.6
	PMP			177.6	1		774.5
During mining (maximum mine development)	10%	0.678	51	34.5	0.42	0.52	3.3
	1%			53.0	0.75		8.0
	0.5%			59.5	0.9		10.6

Table 9.11 Summary of peak flow estimation adjacent to proposed open cut

Scenario	AEP	A (km^2)	t_c (min)	L (mm/h)	C	Diverted pump rate (m^3/sec)	Peak flow rate (m^3/sec)
	0.2%			67.5	0.9		12.0
	0.1%			112.6	0.9		19.6
	PMP			355.7	1		67.5

Notes:
A is the catchment area (km^2);
t_c is the time of concentration (minutes);
L is the main stream length measured to the catchment divide (km);
C is the catchment runoff coefficient varying from 0 to 1 (dimensionless);
PMP is the probable maximum precipitation;
N/A = not applicable.

ii Peak flood level estimates

Peak flood levels were estimated using analytical calculations for a cross-section located at approximately the confluence of Trib C and the Belubula River and adjacent to the proposed open cut mine, for the existing scenario and at the maximum mine development scenario. Estimated peak flood levels are summarised in Table 9.12. The estimated peak flood levels compare with a ground level of 916 mAHD for the edge of the proposed open cut mine. The proposed open cut is another 9 m above this infrastructure at 916 mAHD hence a flood levee is not considered warranted. All other estimated peak flood levels are at approximately 900 mAHD or below.

Table 9.12 shows that the highest estimated peak flood level of 902.7 mAHD is for the existing scenario for a PMP rainfall event. This peak level is 4.3 m below the existing Dungeon Road and a proposed topsoil stockpile at 907 mAHD. The edge of the proposed open cut mine is another 9 m above this infrastructure at 916 mAHD, hence a flood levee is not considered warranted. All other estimated peak flood levels are approximately 900 mAHD or below. Given the elevation of the edge of the proposed open cut, at 916 mAHD, there is negligible potential for flooding of the final void during a PMP rainfall event from the Belubula River downstream of the project area post-closure.

Table 9.12 Summary of peak flood level estimation adjacent to proposed open cut

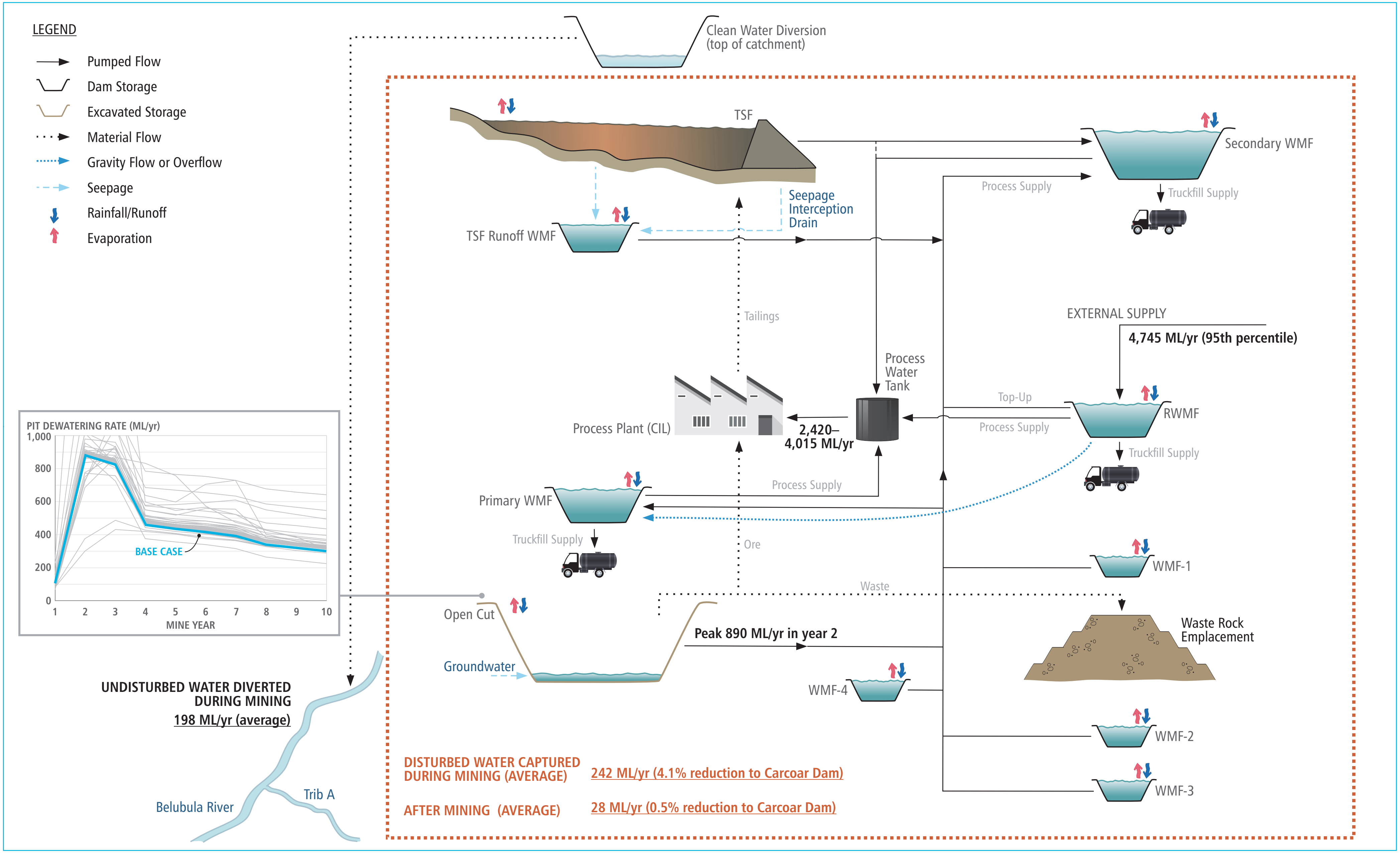
AEP	Existing		During mining (maximum mine development)	
	Flood level (mAHD)	Maximum flow depth (m)	Flood level (mAHD)	Maximum flow depth (m)
10%	898.9	0.92	898.4	0.43
1%	899.4	1.47	898.6	0.67
0.5%	900.0	2.04	898.7	0.77
0.2%	900.1	2.15	898.8	0.82
0.1%	900.2	2.23	899.0	1.04
PMP	902.7	4.71	899.8	1.84

Notes: PMP is probable maximum precipitation

9.5.7 Predicted impacts on water users

The potential effects on sensitive surface water and groundwater users as a result of the mine development, in accordance with the AIP and the assessment criteria as defined in Section 9.3.2, are described below. A schematic summarising the results of the site water balance model and predicted changes to streamflow (including diversions) is presented on Figure 9.28.

- Surface water users and stream environments:
  - Changes to flow for licensed and basic rights users and stream environments due to the reduction in catchment area and reduction in baseflow are predicted to be minor. As discussed in Section 9.5.4, downstream of Trib A, groundwater discharge to the Belubula River is predicted to remain unchanged. Surface water flow and yield changes are considered **minor** and within the natural variability in catchment conditions.
  - Stream bank erosion changes can be mitigated via an erosion and sedimentation control plan. This is further discussed in Section 9.7.1. These changes are considered **minor**.
  - Changes in flood levels as a result of the project are considered acceptable; no flood levee is warranted and there is negligible potential for flooding of the final void from the downstream Belubula River. Changes are considered **minor**.
  - The project is not anticipated to result in a lowering of the beneficial use category of the local surface water sources. Potential for changes in surface water quality due to seepage from the TSF and the waste rock emplacement will be mitigated with appropriate management measures. This is discussed further in Section 9.7. Surface water quality changes are considered **minor**.
- Ecosystems that potentially rely on groundwater:
  - Ecosystems identified to potentially rely on groundwater generally predicted to be unaffected by the project except for communities located on the edge of the pit area. Where present, the predicted impacts can be managed. Effects on GDEs are considered **minor**. Refer to Section 13.5.5 for further details.
- Watercourses, drainage lines, creeks and springs that receive baseflow:
  - Changes in streamflow and spring flow as a result of groundwater drawdown is predicted to occur locally near the open cut mine and is considered **minor**.
- Groundwater users (third party bores and associated infrastructure):
  - Groundwater levels at existing third party bores will experience little to no change as a result of the project and do not trigger the AIP impact criteria for make good requirements. Groundwater level and yield changes in bores are considered **minor**. Refer to Section 9.5.5 for further details.
  - The project is not anticipated to result in a lowering of the beneficial use category of the local groundwater sources. Potential changes in groundwater water quality are not expected to affect third party bores and are considered **minor**.



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Simplified schematic: site water balance results and predicted changes in streamflow

9.6 Licensing

9.6.1 Approach to licensing

Under the WM Act, a proponent of a mining project is required to hold WALs with sufficient water entitlement to account for the take of water from a water source which is not taken pursuant to harvestable rights or a statutory exemption.

As outlined in the AIP, a mining project is required under the WM Act to account for both its direct water take (ie direct take for water supply) and indirect water take, such as the interception of water (indirect pit inflow).

The groundwater model is utilised to predict and quantify the volume of water intercepted during mining and the ultimate sources of that water.

In circumstances where a WAL is required to account for the take of water, the WAL needs to have sufficient water entitlement for the water year in which the take occurs. However, as some take of water may not occur for years after mining commences, it is often not necessary for a mining project to hold all of the WALs it will ultimately require prior to the approval of the project.

9.6.2 Summary of required licence entitlements

i Construction water supply

A water supply for mine development activities and construction of the processing facility and mine infrastructure areas prior to the commissioning of the pipeline before the end of year 1 is required. This water supply will be sourced from a combination of surface water (the Belubula River above Carcoar Dam water source) captured in harvestable rights dams and groundwater from water supply bores taken pursuant to WALs (Lachlan Fold Belt MDB (other) groundwater source). Water will be taken and used for non-potable purposes, including construction activities and dust suppression during mine construction, and is estimated at approximately 438 ML/yr for a period of around 12 months or until the pipeline is commissioned.

The potential effects of water take for construction water supply has been included in this impact assessment. The volume of water proposed to be taken from both surface and groundwater sources is less than the peak take of water during mining, and the modelling to assess the impact of the project considers this disbursed take for construction purposes. The volume of surface and groundwater predicted to be taken during construction is much less than the predicted peak take during operations. As such, the potential impacts of water taken for construction are less than those predicted in the impact assessment in Section 9.5.4.

ii Groundwater interception during and post-mining

The volume of water intercepted and required to be accounted for via WALs for the project includes groundwater inflow to the open cut mine (inclusive of evaporation) plus the induced flow from connected water sources.

During mining, the total annual mine water inflow is predicted to peak in mining year 2 at 890 ML/yr, with a similar rate predicted in mine year 3 (Figure 9.29). The peak is associated with higher permeability and storage within the saprock. In subsequent mining years (4-10), the mine water inflow rate is predicted to reduce and range between approximately 300 and 475 ML/year(Figure 9.29).

Once mining concludes, the void will gradually fill with water. The ongoing interception associated with pit inflow and evaporation loss also requires licensing. The volume of pit inflow reduces following cessation of mining and after two years has reduced to approximately 200 ML/yr. Figure 9.23 indicates that the volume of water inflowing to the pit void is predicted to remain at approximately 200 ML/yr following 100 years post mining.

Based on the results of the groundwater model (Appendix K), the maximum take of groundwater which will need to be accounted for by WALs is 890 ML/yr, which occurs in mining year 2. The ongoing groundwater inflow to the pit void which will need to be accounted for by WALs post mining is 200 ML/yr.

The groundwater inflow is sourced from the Lachlan Fold Belt Murray Daring Basin Groundwater Source, with a very minor contribution over time from the overlying water source.

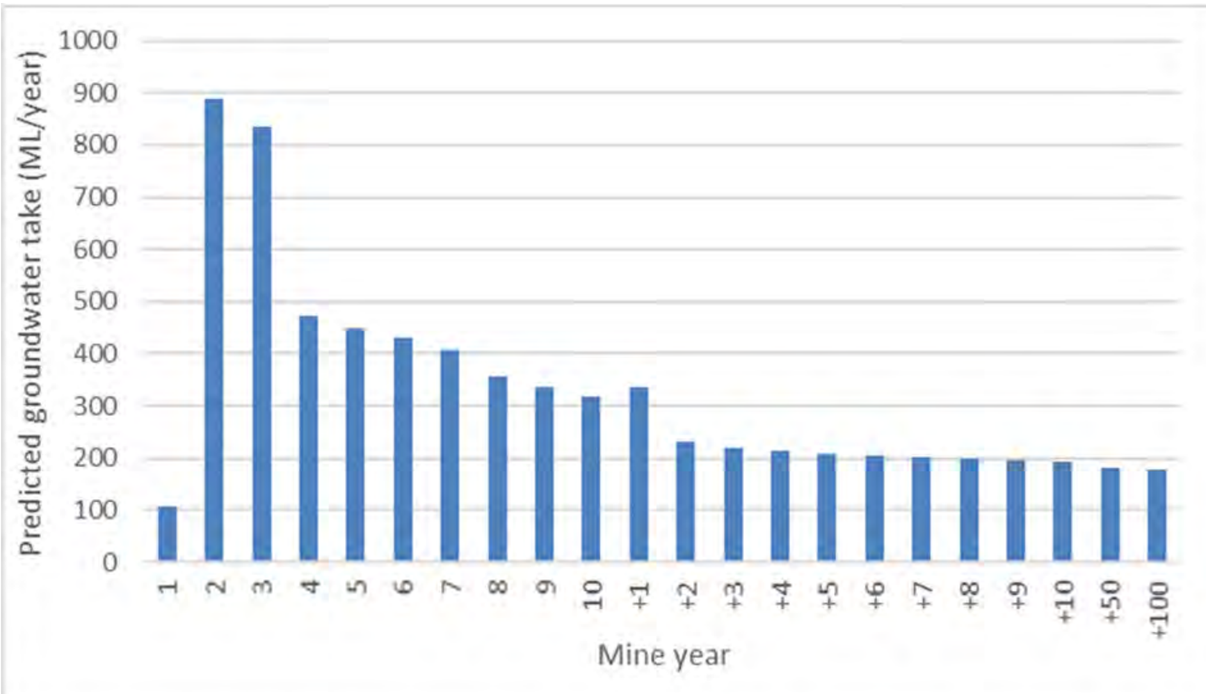


Figure 9.29 Predicted groundwater take (direct and indirect) over time

iii Surface interception during and post-mining

Regis will secure sufficient licence entitlements in the Belubula River above Carcoar Dam water source to account for the indirect induced surface water leakage to the underlying groundwater source.

Disturbed catchment areas

The take of dirty water from disturbed catchment areas by way of dirty water dams is exempt from the need for WALs if the Excluded Works Exemption applies. The take of water by the following category of dams is exempt from section 60A(1) and (2) of the WM Act:

> Dams solely for the capture, containment and recirculation of drainage and/or effluent, consistent with best management practice or required by a public authority (other than Landcom or the Superannuation Administration Corporation or any of their subsidiaries) to prevent the contamination of a water source, that are located on a minor stream.

The project will rely on the Excluded Works Exemption by designing and constructing the surface water management system such that each of the project's dirty water management dams are located on a minor stream. Consistently with established best management practice for mines, the reuse of dirty water captured by the project's dirty water management dams will be maximised.

Non disturbed catchment areas

Clean water from undisturbed areas of the catchment will be diverted around disturbed areas and into the Belubula River. The clean water diversion system will be designed so as to minimise volumetric losses.

The estimated volume of water which will diverted and delivered into the Belubula River in an annual median year will be 198 ML/yr. The diversion of this clean water is solely for the benefit of the environment and community.

Induced leakage from groundwater drawdown

A WAL will be held to account for the induced leakage from the overlying surface water system as a result of groundwater drawdown surrounding the open cut. The groundwater model predicts this take to peak 100 years post-mining at 31 ML/yr.

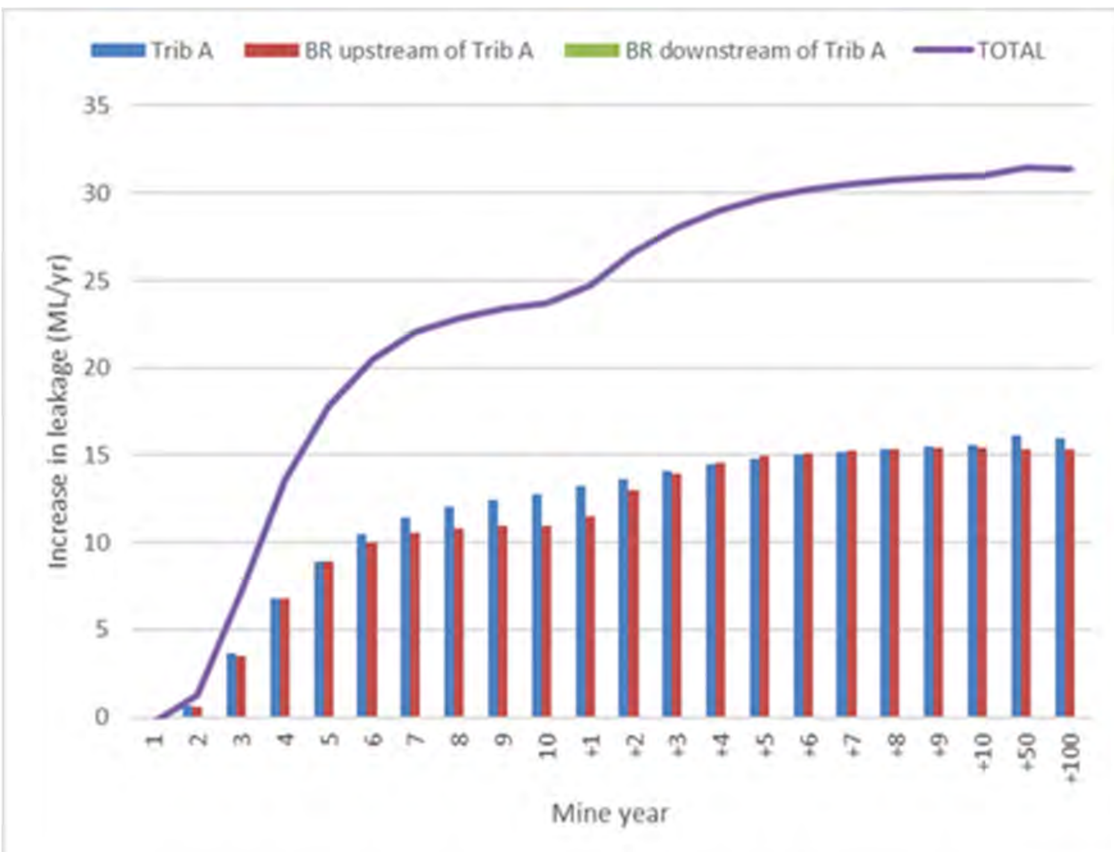


Figure 9.30 Predicted induced surface water leakage due to groundwater drawdown

9.6.3 Licences held by Regis Resources

Regis has secured 400 shares (equivalent to 400 ML) of groundwater in the Lachlan Fold Belt MDB Groundwater Source as at July 2019 and is in the process of securing shares in the unregulated Belubula River above Carcoar Dam surface water source.

9.6.4 Mechanism to secure the required licence entitlements

Regis has secured approximately 45% of the required groundwater licence volume, with a clear pathway for how the remaining licence volume will be secured to meet extraction requirements.

i Groundwater

Application for water from the Lachlan Fold Belt MDB Groundwater Source through controlled allocation is proposed to secure the remaining groundwater licence volumes. Regis will apply through controlled allocation for the remaining 490 ML of groundwater licence requirements in order to secure a total required volume of 890 ML.

The next controlled allocation process is scheduled for October 2019, noting that licences can be traded at any time. There are sufficient licence entitlements available in the Lachlan Fold Belt MDB Groundwater Source and a clear pathway to secure the remaining volume required.

ii Surface water

The project will require a surface water entitlement of 24 ML/yr during mining and up to 31 ML/yr at 100 years post mining to account for the induced leakage from the overlying surface water system as a result of groundwater drawdown surrounding the open cut. Trading of surface water entitlement within the unregulated Belubula River above Carcoar Dam water source is proposed to secure this required water entitlement.

There are three WALs for the Belubula River above Carcoar Dam surface water source, with respective allocations of 22 ML (WAL36818), 50 ML (WAL31476), and 192 ML (WAL31475). Both WAL36818 and WAL31476, with a combined allocation of 72 ML, are potentially available for trading. While WAL31475 was surrendered by the Water Administration Ministerial Corporation, it is still an active licence. Regis is having ongoing discussions with the three licence holders with a view to securing the required volume of 31 ML.

In addition to the trading from the pool of three licences, it is understood that the NSW Government is considering amending the relevant WSP to allow trading of water upstream. This would provide an additional pathway for Regis to secure the required water entitlement. The proposed amendment is in accordance with the note in the draft Lachlan Surface Water Resources Plan. This would allow allocation for 'high security' within the Belubula River to be traded upstream, within the Lachlan River Water Sources, to offset or accommodate the volume required.

9.7 Management and mitigation

Numerous alternative designs have been prepared and evaluated for the mine development, as discussed in detail in Chapter 6. This process has facilitated the development of a considered, well-designed project that will efficiently recover a highly valuable resource, while minimising environmental impacts. Proposed mitigation, management and monitoring measures are presented in the following sections to further reduce the potential impact of the project on sensitive receptors.

The water management strategy for the project includes:

- diverting clean water around the mining disturbance areas into the Belubula River;

- capturing dirty water from disturbed areas for recycling and reuse and to prevent the contamination of downstream watercourses;
- designing the water management system so that storages have <1% or no spill risk;
- implementing the seepage management system at the TSF during construction, operations and closure;
- managing waste placement to limit the duration that PAF material is exposed; and
- conditioning of water management facilities as part of construction to prevent loss of water (as vertical leakage).

The water management strategy is described further in the Surface Water Assessment (Appendix J).

9.7.1 Water management plan

Two main water management plans (WMPs) will be developed for the project post-approval: one for the construction phase (CWMP) and one for the operational phase (OWMP). The WMPs will be a sub-plan of the environmental management system. The WMPs will document the proposed mitigation and management measures for the approved project, and will include the surface and groundwater monitoring program, reporting requirements, spill management and response, water quality trigger levels, corrective actions, contingencies, and responsibilities for all management measures.

The WMPs will be prepared in consultation with DPIE Water, the EPA and NRAR and will consider concerns raised during the exhibition and approvals process for the project.

The WMPs will include details of:

- the surface water and groundwater monitoring program, including the monitoring network;
- monitoring frequencies;
- water quality constituents;
- physical water take and pumping volumes between water storage structures (including the open cut mine);
- trigger levels for water quality parameters to assist in early identification of water quality trends (including TSF seepage migration);
- a trigger action response plan;
- an erosion and sediment control plan;
- groundwater quality performance and early warning triggers based on statistical analysis of the reported ranges in baseline concentrations of identified analytes of concern (eg pH, salinity concentrations, and concentrations of other analytes such as, CN (WAD and Total), S, SO_4, Se, F, and Al);
- groundwater ‘quantity’ (head) performance will be based on a combination of baseline head data for selected monitoring bores as well as comparison of observed and model predicted heads for different stages of mine development (operational and closure); and
- a program for reviewing and updating the numerical groundwater model as more data and information become available; this program will include reporting requirements.

The requirements for storing fuels and other potential contaminants on site (to minimise risk of spill) will be addressed in the hazardous goods management plan. Reporting frameworks will be prepared in accordance with licensing and agency requirements. The monitoring program will be prepared in accordance with the development consent conditions and approved project's environment protection licence (EPL).

9.7.2 Monitoring

The baseline surface water and groundwater monitoring network is discussed in Section 9.2 and Appendix J and K. Data will continue to be collected from Regis' project specific monitoring locations throughout the life of the mine. The monitoring program will provide an early indication of potential impact to sensitive receptors, including the Belubula River, GDEs, and existing users.

As part of the WMP, the existing environmental monitoring network will be reviewed and adjusted to ensure adequate spatial coverage and collection of data to validate and update groundwater modelling predictions. The ongoing development and expansion of the monitoring network will occur in consultation with NRAR and DPIE Water, and as per the guidelines for the groundwater monitoring and modelling plan (GMMP), which will evolve as the project progresses.

Additional baseline monitoring and assessments are proposed to provide further information on existing surface water-groundwater interactions (ie groundwater interaction with springs and the Belubula River) and additional baseline data in the TSF and waste emplacement areas:

- The following surface water monitoring program will be commenced during construction:
  - conduct a comprehensive surface water monitoring project across the mine project area to collect data from all identified spring locations;
  - conduct additional baseline surveys on landholder property downstream of the project area, along the Belubula River, including collecting information regarding springs and existing bores;
  - conduct follow up surveys at the previously surveyed sites to confirm the results of the subterranean fauna surveys and to identify macroinvertebrates to species level to assess the uniqueness of the fauna identified at the springs and assess the reliance on groundwater;
  - install surface water flow monitoring locations in the mine development area;
  - install additional groundwater monitoring bores in the TSF area (for monitoring until project infrastructure removes the bores) and south, west and east of the TSF (for monitoring prior to, during and post-mining); and
  - installation of additional groundwater monitoring bores in the vicinity of the waste rock emplacement area and water management facilities (for monitoring prior to and during operations).
- The following monitoring will be conducted during operations:
  - routine monitoring of all three proposed streamflow monitoring stations, including continuous water quality monitoring sensors for pH, EC, temperature and turbidity;
  - annual monitoring via established photo and assessment points on the Belubula River downstream of the proposed TSF (to be established immediately prior to construction) at approximately 50 m intervals;
  - routine monitoring of water quality for all site water storages;

- routine health monitoring of PCT 951 vegetation;
- routine inspections of sediment control structures as well as inspections following rainfall events of 20 mm or more in a 24 hour period;
- monitoring of the stored water volume in each storage on site, including the open cut; and
- monitoring of volumes of water pumped between selected storages in the water management system.

All water quality monitoring will be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (2004). Monitoring results will be reported to regulators and the CCC in accordance with annual review requirements. The need for, and methodology of, ongoing water monitoring after mining has ceased will be confirmed during development of the detailed mine closure plan.

Threshold levels for the management of various water-related aspects of the project will be developed in the WMPs.

9.7.3 Management measures

Potential hazards to the mine development have been assessed as part of the Preliminary Hazard Analysis (PHA) and are provided in Appendix R. Table 9.13 lists potential risks to the mine development from potential deviations from the model predictions and identified impacts presented. Proposed management measures are also provided.

Table 9.13 Potential deviation from model predicted impacts and management measures

Potential impact	Management measure
Drawdown in landholder bores is significantly larger than predicted	Make good arrangements (see above) Groundwater monitoring to provide early indication of potential change in predicted impacts.
Groundwater inflow rates to the open cut are higher than predicted, affecting water management system, project licensing (compliance)	Metering and monitoring will be in place to record the volume of water removed from the proposed open cut. Use of pit inflow water as a priority over external water supply. Notify regulators. Standby pumps to increase volume removed from the open cut for safe mining. Review of groundwater model
Water supply security during construction and operations	Construction water supply will be sourced from within the site water management system. Supplementary construction water supply will be sourced from off site and will be appropriately licensed. The external water supply pipeline will be in place prior to processing commences.
Impacts on baseflow to Belubula River are greater than predicted	Surface water flow monitoring data to be collected prior to project commencement to improve conceptual understanding. Monitoring during operations to provide indication of impact. Triggers to be assigned within WMP. Notify regulators.

Table 9.13 Potential deviation from model predicted impacts and management measures

Potential impact	Management measure
Seepage of TSF leachate affects water quality of clean water diversion system	Water diverted from upstream of the TSF will be routinely tested before discharged to the Belubula River downstream of the project (TDS/EC and pH will be indicators).
Groundwater mounding and / or seepage at the TSF embankments affects embankment stability	Vibrating Wire Piezometers will be installed within TSF embankments to monitor pore pressures. Routine monitoring of embankment areas.

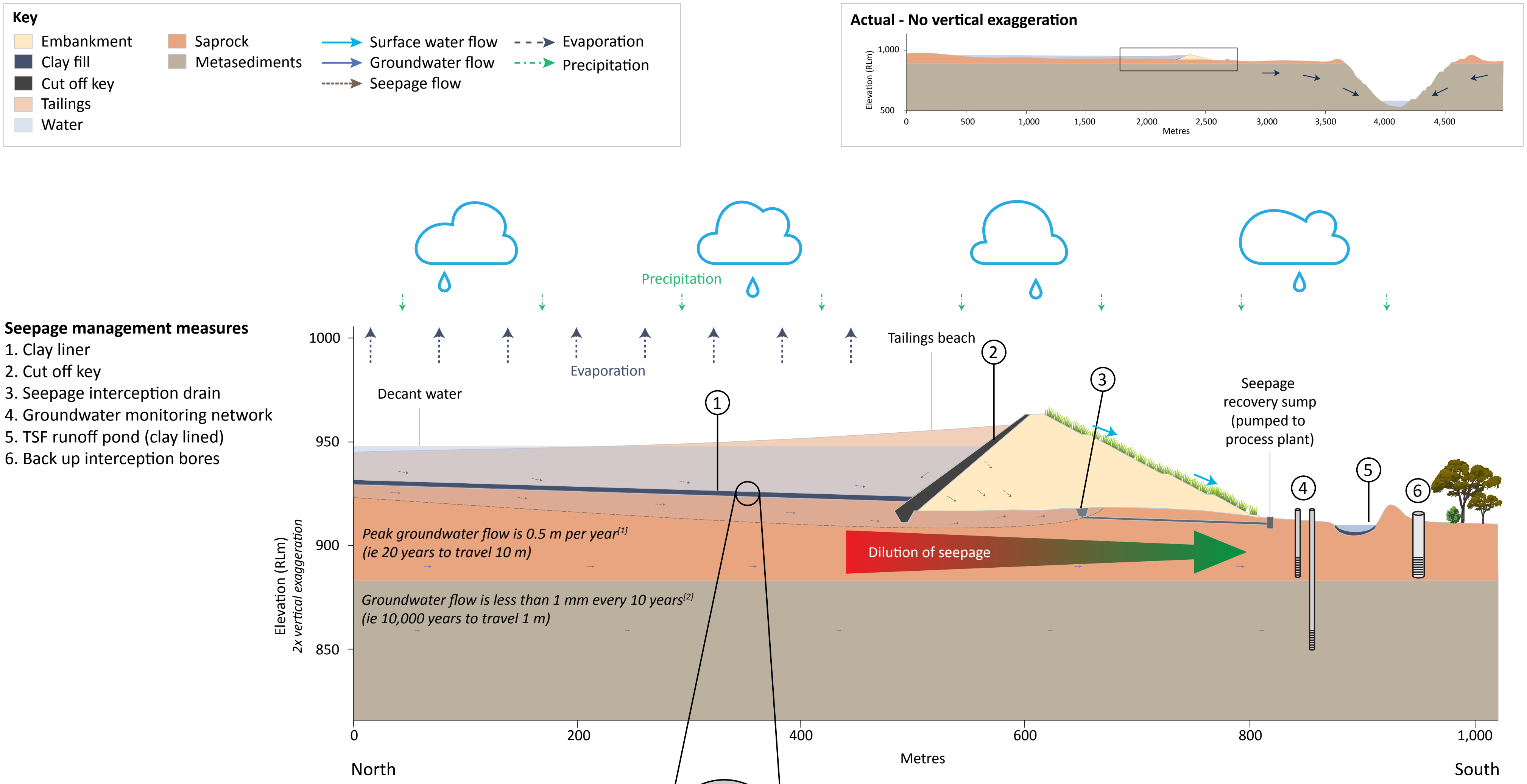
i TSF seepage management

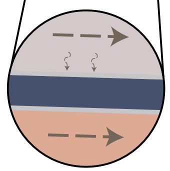
The TSF is designed to operate effectively and efficiently, and in consideration of the requirements of the NSW Government. The TSF is designed specifically to avoid adverse impacts to the surrounding environment, including being designed to contain all water during large rainfall events (no spill risk) (refer Appendix J)

The design of the TSF includes additional safeguards for seepage management (refer to ATC Williams (2019) TSF design report) including:

- the embankment foundations will be cleared, stripped and excavated to remove weak, compressible or over-saturated soils;
- the in-situ material (surface geology) has a low hydraulic conductivity and will therefore minimise the vertical movement of seepage from the TSF;
- prior to tailings placement, a low permeability liner (as clay or geofabric liner where insitu material does not meet design criteria for permeability) will be placed in the storage floor to reduce the potential for seepage from the TSF;
- a drain will be constructed at the toe of the embankment, which will capture seepage from the TSF and will then be recirculated back to the TSF decant area;
- a low permeability core zone will be included as part of construction of the embankment;
- groundwater monitoring bores will be installed around the TSF to monitor for early warning of potential seepage from the TSF; and
- downstream of the monitoring network, seepage interception bores will be in place to operate as backup seepage collection points to intercept any potential seepage before it progresses further into the catchment (ie downstream towards the Belubula River).

A schematic of the proposed seepage management system is presented in Figure 9.31.





Notes:

- [1] The saprock has a bulk permeability in the order of 1 x 10^{-2} metres per day.
- [2] The metasediments have a bulk permeability in the order of 1 x 10^{-7} metres per day.
- Diagram shows vertical exaggeration (2x).
- The TSF overlies the weathered metasediment of the Anson Formation (saprock).

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TSF- seepage management system - conceptual cross section

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Figure 9.31

9.7.4 Groundwater model validation and review

Future improvements to the numerical groundwater flow model will be undertaken as and when new data become available, particularly where there is a divergence of observed groundwater system response from the predicted. Groundwater monitoring data will be used to verify and validate the groundwater model predictions. New data may require a revision and update of the conceptual hydrogeological model prior to updating and recalibrating the numerical model and re-running of predictive scenarios. Where this is deemed necessary, the WMP may also need to be updated depending on any changes to the conceptualisation and model predictions.

As mining progresses, a need for further model updates will be assessed every two years based on evaluation of groundwater monitoring data and findings of impact verification. It is expected the confidence level of model predictions will increase over time as the model is updated to reflect the observed effects on groundwater from the monitoring program.

Where additional management strategies are required in response to environmental performance, the existing numerical model will be used to test the effectiveness of mitigation measures prior to implementation to improve the outcomes of the proposed measures.

9.8 Conclusions

The following is a summary of the outcomes of the assessed impacts of the project on water resources:

- The design of the water management system has been optimised to minimise disruption of and to avoid discharge of process affected water to surface water systems.

- Numerical modelling and analytical techniques have been used to develop the site water balance, investigate potential changes in flood extent, and predict water quantity and quality changes to surface water and groundwater resources. The impacts on surface water and groundwater as a result of the mine development are predicted to be minimal and impacts to downstream water users are predicted to be minor.

- Groundwater levels will decline in a localised area surrounding the open cut mine. The AIP requires 'make good' provisions to be made for landholder bores affected by a greater than 2 m drawdown as a result of the project: however, there are no third party bores with a predicted drawdown in excess of 2 m.

- A temporary reduction in the inflow to Carcoar Dam (4%) will occur as a result of construction and operation of the mine. Permanently, following mine-closure and rehabilitation, the reduction in flows will be much smaller (0.5% reduction). This level of change is expected to be within the current natural variability in catchment conditions.

- Upstream of the Trib A confluence, a 15% reduction in baseflow to surface water (ie the Belubula River) in the local area is predicted to occur during and after mining. However, under existing pre-mining conditions baseflow is predicted to contribute only around 5% to the overall surface water flows in this area.

- Downstream of Trib A, there is no change in groundwater discharge or river leakage predicted to occur during and after mining.

- At maximum disturbance, flows in the Belubula River below the Mid Western Highway and above Carcoar Dam is expected to range between at least 636 ML/yr and 1,402 ML/yr during periods of low rainfall. During these periods of low rainfall when downstream users are most reliant on water within the Belubula River, groundwater discharge as baseflow in the Mid Western Highway area is predicted to remain unchanged from current conditions.

- The project is not anticipated to result in a lowering of the beneficial use category of the local water sources. Water quality affects will be able to be mitigated and/or managed appropriately.

- Changes to flood levels and flood peak velocities are considered minimal and a construction of flood levee is not warranted.

- The results of groundwater modelling predict reduced access to the watertable for Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (PCT 951) on the edge of the disturbance boundary, in the pit area. Closer to the Belubula River, north of the pit, where other PCT 951 trees are mapped, vegetation in this area is unlikely to be affected by the mine development.

Monitoring of the water monitoring network will continue, and the network will be expanded to target the identification of potential impacts from mining activities. Monitoring each component of the water management system underpins if, how, and when management responses are required. Triggers and thresholds will be developed to provide context on if, how, and when management measures are required as part of the water management plan for the project.

Chapter 10

Noise, vibration and blasting

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10 Noise, vibration and blasting

10.1 Introduction

A noise and vibration impact assessment (NVIA) was conducted by Muller Acoustic Consulting (MAC 2019a) to assess the predicted noise and vibration impacts associated with the construction and operation of the mine development. The NVIA also describes the initiatives built into the project design to avoid and minimise impacts and identifies the additional mitigation and management measures to be implemented to address residual impacts. The NVIA is provided in full in Appendix L.

The project design, in conjunction with the noise assessment, considered feasible and reasonable mitigation measures in accordance with the guidance provided in the *Noise Policy for Industry* (EPA 2019) to minimise noise and vibration impacts on sensitive receivers. The design process was therefore an iterative one, with the project layout and design altered as various scenarios were modelled. In particular, the design and scheduling of the waste rock emplacement evolved as a result of noise modelling outputs, particularly with reference to potential impacts on Kings Plains residences. This evolution in project design is discussed in detail in Chapter 6, and also in this chapter in Section 10.5 with particular reference to achieving beneficial noise outcomes.

10.2 Assessment requirements and methods

The EARs require an assessment of the likely noise and vibration impacts of the project. The specific requirements relating to noise and vibration are provided in Table 10.1.

Table 10.1 Noise, vibration and blasting related EARS for the mine development

Requirement	Where addressed
Noise, vibration and blasting – including:	Appendix L
• an assessment of the likely operational noise impacts of the development (including construction noise) in accordance with the *Noise Policy for Industry NSW*, and the *Voluntary Land Acquisition and Mitigation Policy*;	10.6.2
• if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities in accordance with the *Interim Construction Noise Guideline*;	10.6.1
• an assessment of the likely road noise impacts of the development in accordance with the NSW *Road Noise Policy*; and	10.6.3
• an assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guideline.	10.6.4

The NVIA was prepared to address the EARs in Table 10.1 and in consideration of the following guidelines, policies and industry requirements:

- *Noise Policy for Industry* (EPA 2017) (NPfI);
- *Interim Construction Noise Guideline* (ICNG) (DECC 2009);
- *Voluntary Land Acquisition and Mitigation Policy* (DPEa 2018) (VLAMP);
- *Construction Noise and Vibration Strategy* (TfNSW 2018);
- *Road Noise Policy* (DECCW 2011a) (RNP);

- *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC 1990); and

- *Assessing Vibration: A Technical Vibration* (DEC 2006).

A computer model was developed by MAC to determine the impact of project noise emissions on neighbouring receivers for construction and operational phases. DGMR's iNoise (Version 2019) noise modelling software was used to assess potential noise impacts associated with the mine development in accordance with ISO 9613-1 and ISO 9613-2. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. Additionally, the model uses relevant noise source data representative of each construction and operational activity, ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Plant and equipment were modelled at various locations and heights, representative of realistic construction and operational conditions for assessed scenarios.

10.3 Existing environment

10.3.1 Properties surrounding the project

The NVIA considered 88 residential receivers surrounding the mine project area (R1 to R88). These residences are referred to as assessment locations and are illustrated in Figure 10.1. The assessment locations are considered representative of all residential locations and catchments surrounding the mine project area and were identified using aerial photography, local knowledge of the area of the Regis project team, and verification in the field. For the purposes of the NVIA, the assessment locations have been split into four catchments grouping residences together that are in a similar background acoustic environment. These catchments are listed below and shown in Figure 10.1.

- **Distant Rural** – rural receivers that are typically rural in nature with low background noise levels and are generally more than 2 km from the project area boundary;

- **Sturgeon Hill** – receivers to the south west of the mine development;

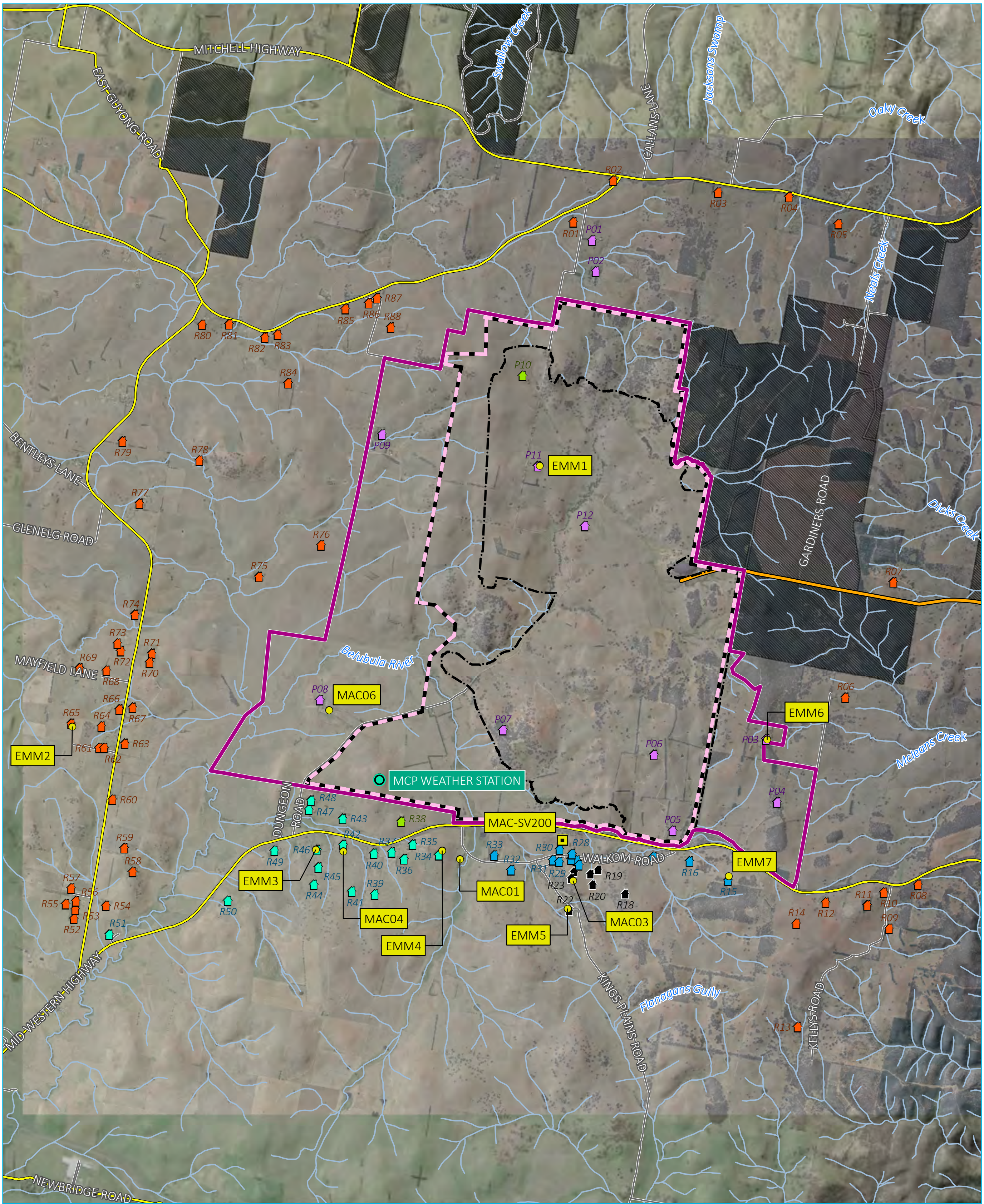
- **Walkom Road** – receivers in the Kings Plains locale that are not influenced by road traffic noise from the Mid Western Highway; and

- **Kings Plains** – receivers situated in the Kings Plains locale that are in closer proximity to the Mid Western Highway.

10.3.2 Background noise monitoring

Noise monitoring was conducted to characterise the existing noise environment around the project area. To quantify background noise levels, historic long-term unattended noise monitoring results (EMM 2013) was reviewed, and then additional monitoring undertaken in July 2018 by MAC. Additionally, Regis deployed a noise monitoring terminal in the area, from which the data was used for comparison and validation where required. All available data was analysed to determine receiver noise catchment areas and their respective rating background levels (RBLs).

The results of MAC's unattended noise monitoring in July 2018 are provided in Table 10.2, along with the adopted RBL. Noise monitoring locations are illustrated in Figure 10.1.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); MAC (2019); DFSI (2017); GA (2011)

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KEY

- Noise monitoring location
- Noise monitoring terminal
- Weather station

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Sensitive receptor (by noise catchment)

- Regis-owned
- Residences under option
- Distant rural
- Kings Plains
- Sturgeon Hill
- Walkom Rd

Existing environment

- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

Sensitive receivers and noise monitoring locations

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Figure 10.1

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Table 10.2 Unattended noise monitoring results around the mine project area

Catchment	Period	Measured rating background level (RBL) L_{A90}	Adopted RBL L_{A90}	Measured ambient noise level $LA_{eq(period)}$
Distant Rural R1 to R14 and R52 to R88	Day	29	35	53
	Evening	25	30	47
	Night	24	30	47
Kings Plains R15 to R17 and R25 to R33	Day	36	36	51
	Evening	31	31	50
	Night	26	30	48
Walkom Road R18 to R24	Day	35	35	47
	Evening	30	30	43
	Night	24	30	43
Sturgeon Hill R34 to R51	Day	35	35	52
	Evening	33	33	50
	Night	25	30	48

Note: Day is the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays, evening is the period from 6 pm to 10 pm and night are the remaining periods.

Note: Where this level is less than 35 dB(A) for the day period, the rating background noise level is set to 35 dB(A). Where the noise level is less than 30 dB(A) for the evening and night periods, the rating background noise level is set to 30 dB(A).

The existing noise environment of residential receivers is indicative of a rural environment, which is dominated by natural sounds, generally minimal road traffic noise and low background noise levels.

10.3.3 Meteorology

Regis maintains a meteorological monitoring station as part of its monitoring network within the mine project area, as shown in Figure 10.1. The data collected from this weather station during the period December 2017 to December 2018 was used in the noise model to represent the existing environment.

i Temperature inversions

Temperature inversions (ie where atmospheric temperature increases with altitude) typically occur over cooler times of the year during night periods and can focus mine noise levels at surrounding locations. In accordance with the NPfI, temperature inversions are to be considered when they occur for 30% of the time (approximately two nights a week).

An analysis of meteorological data from the onsite weather station was conducted, finding that stability class F and G conditions do not occur more than 30% of the time during winter evenings and nights and are therefore not a feature of the area.

ii Wind

During certain wind conditions, noise levels at sensitive receptors may increase or decrease compared with noise during calm conditions. As per the NPfI, winds of up to 3 m/s must be considered in noise predictions when they occur for more than 30% of the time during day, evening or night. Data collected at the meteorological weather station in the mine project area was analysed using EPA's Noise Enhancement Wind Analysis Program to determine the frequency of occurrence of wind speeds up to 3 m/s for each season.

The analysis found that wind speeds of up to 3 m/s are not a feature of the project area and surrounds and are therefore not required to be considered in the noise impact assessment. The weather data recorded on site shows a high proportion of elevated wind speeds (greater than 5.5 m/s) across all years, with predominately easterly and westerly winds, and a minor north-westerly component.

10.4 Noise criteria

10.4.1 Construction noise

The ICNG provides both a qualitative and quantitative method for assessing construction noise emissions. The quantitative method is suited to major construction projects that typically last more than three weeks, and as such was used in the assessment of potential noise impacts during the construction phase of the project.

Construction noise criteria has been applied to the first six months of the mine development during the initial site establishment phase. Activities will generally occur during the standard daytime hours only in this period, as described further in Section 10.6.1. Outside of these hours, some limited works will be carried as required (such as limited construction activities, environmental management activities such as dust control, delivery of oversized equipment, and servicing of equipment). In these circumstances, works will be undertaken in accordance with the noise criteria for outside of recommended standard hours in the ICNG.

The applicable construction noise criteria for residential assessment locations, called noise management levels (NML) as per the ICNG, are provided in Table 10.3.

Table 10.3 Construction noise management levels for residential land uses

Time of day	Management level $L_{eq(15\ min)}$	Application
Recommended standard hours: • Monday to Friday 7:00 am to 6:00 pm; • Saturday 8:00 am to 1:00 pm; and • no construction work on Sundays and public holidays.	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measures $L_{eq(15\text{-}min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Table 10.3 Construction noise management levels for residential land uses

Time of day	Management level $L_{eq(15\ min)}$	Application
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: – times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences); and – if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for work outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

The NMLs for standard construction hours and out of hours periods are provided in Table 10.4. This is the RBL for each residential receiver, as provided in Table 10.2, plus 5 to 10 dB(A).

Table 10.4 Construction noise management levels for the mine development

Catchment and receiver ID	Assessment period	RBL dB LA_{90}	NML (dB(A)) $L_{Aeq\ 15\ min}$
Distant Rural R1 to R14 and R52 to R88	Day	35	45
	Out of hours period 1	30	35
	Out of hours period 2	30	35
Kings Plains R15 to R17 and R25 to R33	Day	36	46
	Out of hours period 1	31	36
	Out of hours period 2	30	35
Walkom Road R18 to R24	Day	35	45
	Out of hours period 1	30	35

Table 10.4 Construction noise management levels for the mine development

Catchment and receiver ID	Assessment period	RBL dB LA_{90}	NML (dB(A)) $L_{Aeq\ 15\ min}$
	Out of hours period 2	30	35
Sturgeon Hill R34 to R51	Day	35	45
	Out of hours period 1	33	38
	Out of hours period 2	30	35

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Construction activities from midway through PY1 to PY2 will overlap with mining operations for which a maximum level screening assessment has been completed. Table 10.5 summaries the standard and out of hours periods for construction.

Table 10.5 Recommended hours for construction

Period	Preferred construction hours
Standard construction hours	Monday to Friday – 7 am to 6 pm. Saturdays – 8 am to 1 pm. Sundays or public holidays – no construction.
Out of hours period 1	Monday to Friday – 6 pm to 10 pm. Saturdays – 7 am to 8 am and 1 pm to 10 pm. Sundays or public holidays – 8 am to 6 pm.
Out of hours period 2	Monday to Friday – 10 pm to 7 am. Saturdays – 10 pm to 8 am. Sundays or public holidays – 6 pm to 7 am.

10.4.2 Operational noise

The objective of noise criteria for industry is to protect the community from excessive intrusive noise and to preserve amenity for specific land uses.

In accordance with the EPA's NPfI, the operational noise criteria that are to be applied to sensitive receptors are expressed as Project Noise Trigger Levels (PNTLs), which are the lower (more stringent) of the project intrusiveness noise level and the project amenity noise level. The PNTL is defined in the NPfI as the level that provides a *benchmark* or *objective* for assessing a proposal or site. It is not intended for use as a mandatory requirement. The PNTL is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures.

The intrusiveness noise level is equal to the RBL plus 5 dB(A), meaning that the equivalent continuous noise levels of the source should not be more than 5 dB(A) above the measured background level.

The amenity assessment is based on noise criteria specific to land use and associated activities that relate only to industrial type noise and do not include road, rail or community noise.

The PNTLs for the mine development, as derived from the intrusive noise level (RBL + 5 dB) and the amenity noise level in accordance with the NPfI, are presented in Table 10.6.

Table 10.6 Project specific operational noise levels for the mine development, dB(A)

Catchment and receiver ID	Assessment period	Intrusive noise level $L_{Aeq(15\ min)}$	Amenity noise level $L_{Aeq(15\ min)}$	PNTL $L_{Aeq(15\ min)}$
Distant Rural R1 to R14 and R52 to R88	Day	40	53	**40**
	Evening	35	48	**35**
	Night	35	43	**35**
Kings Plains R15 to R17 and R25 to R33	Day	41	53	**41**
	Evening	36	48	**36**
	Night	35	43	**35**
Walkom Road R18 to R24	Day	40	53	**40**
	Evening	35	48	**35**
	Night	35	43	**35**
Sturgeon Hill R34 to R51	Day	40	53	**40**
	Evening	38	48	**38**
	Night	35	43	**35**

10.4.3 Voluntary land acquisition and mitigation policy

The NSW Government's Voluntary Land Acquisition and Management Policy (VLAMP) seeks to balance acquisition and mitigation obligations for mine operators with providing appropriate protections for landholders where impacts related to noise are significant. The consent authority is required to consider the VLAMP in determining applications for State significant mining, petroleum and extractive industry projects.

The VLAMP's voluntary mitigation and acquisition rights are assigned to privately owned dwellings based on the level of predicted noise above the PNTL, as explained in Table 10.7.

Table 10.7 Characterisation of noise impacts and potential treatments as per the VLAMP

Predicted noise level minus the project noise trigger level	Total cumulative industrial noise level	Characterisation of impacts	Potential treatment
0-2 dB(A) All time periods	Not applicable.	Impacts are considered to be **negligible**.	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls
3-5 dB(A) All time periods	• recommended amenity noise level in Table 2.2 of the NPfI; or • recommended amenity noise level in Table 2.2 of the NPfI, but the increase in total cumulative industrial noise level resulting from the development is > 1dB	Impacts are considered to be **marginal**.	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.

Table 10.7 Characterisation of noise impacts and potential treatments as per the VLAMP

Predicted noise level minus the project noise trigger level	Total cumulative industrial noise level	Characterisation of impacts	Potential treatment
3-5 dB(A) All time periods	Recommended amenity noise level in Table 2.2 of the NPfl, and the increase in total cumulative industrial noise level resulting from the development is >1dB.	Impacts are considered to be **moderate**.	As for marginal impacts but also upgraded facade elements like windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Day and evening > 5 dB(A)	Recommended amenity noise levels in Table 2.2 of the NPfl.	Impacts are considered to be **moderate**.	As for marginal impacts but also upgraded facade elements like windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Day and evening > 5 dB(A)	Recommended amenity noise levels in Table 2.2 of the NPfl.	Impacts are considered to be **significant**.	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.
Night > 5 dB(A)	Not applicable.	Impacts are considered to be **significant**.	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.

The VLAMP also provides noise acquisition criteria for privately owned land parcels. The policy assigns acquisition rights if the noise generated by a development contributes to an exceedance of the recommended maximum noise levels on more than 25% of any privately-owned land, where a dwelling could be built on the land under existing planning controls. Predicted noise levels show this will not occur (refer to Section 10.6.2).

The VLAMP criteria specific for the mine development is provided in Table 10.8. An impact assessment of operational noise against these criteria is provided in Section 10.6.2.

Table 10.8 VLAMP mine development specific criteria

Catchment	Period	PNTL dB $LA_{eq(15\ min)}$	VLAMP significant impact threshold		
			Voluntary mitigation and acquisition		Vacant land acquisition
			PANL dB $L_{Aeq(period)}$	PNTL + 5 dB	PANL + 5 dB
Distant Rural R1 to R14 and R52 to R88	Day	40	50	**45**	55
	Evening	35	45	**40**	50
	Night	35	40	**40**	45
Kings Plains R15 to R17 and R25 to R33	Day	41	50	**46**	55
	Evening	36	45	**41**	50
	Night	35	40	**40**	45

Table 10.8 VLAMP mine development specific criteria

Catchment	Period	PNTL	VLAMP significant impact threshold		
Walkom Road	Day	40	50	**45**	55
R18 to R24	Evening	35	45	**40**	50
	Night	35	40	**40**	45
Sturgeon Hill	Day	40	50	**45**	55
	Evening	38	45	**43**	50
R34 to R51	Night	35	40	**40**	45

10.4.4 Low frequency noise

Fact Sheet C of the NPfI provides guidelines for applying the 'modifying factor' adjustments to account for low frequency noise emissions.

This has been assessed for residential receivers located within 3 km of major noise sources, including the open cut mine, waste rock emplacement and processing area. Where the difference between the dB(C) and dB(A) is more than 15 B, a 2 dB penalty has been applied to the predicted operational PNTL at residential receivers.

10.4.5 Sleep disturbance

The potential for sleep disturbance due to maximum noise level events during the night period has been considered for construction and operation phases.

The maximum noise level screening criteria for the night period is 40 $L_{Aeq(15\ min)}$ and 52 dB $L_{AMAX,}$ which applies to all residential receivers during construction and operation phases. As recommended in Section 2.5 of the ICNG (DECC 2009), noise levels at residential receivers during the night period should not exceed:

- 40 dB $L_{Aeq(15\ min)}$ or the prevailing RBL plus 5 dB, whichever is the greater number; and
- 52 dB L_{AMAX} or the prevailing RBL plus 15 dB, whichever is the greater number.

10.4.6 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

Clause 12AB of the Mining SEPP identifies non-discretionary development standards for mining. The Clauses relevant to the mine development are listed below.

> Clause 12AB(1):
>
> The object of this clause is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standards is not complied with).
>
> Clause 12AB(3) Cumulative noise level:
>
> The development does not result in cumulative amenity noise criteria greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Noise Policy for Industry, for residences that are private dwellings.

Other clauses of interest for the mine development are listed below.

Clause 12AB(5) Airblast overpressure:

Airblast overpressure caused by the development does not exceed:

d) 120 dB (Lin Peak) at any time, and

e) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

Clause 12AB(6) Ground vibration:

Ground vibration caused by the development does not exceed:

f) 10 mm/sec (peak particle velocity) at any time, and

g) 5 mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

The above clauses are consistent with cumulative noise and blasting criteria adopted for the mine development.

10.4.7 Road traffic noise

The road traffic noise assessment criteria for residential land uses (ie sensitive receivers), as noted in the RNP, is provided in Table 10.9.

Table 10.9 Road traffic noise assessment criteria for residential land uses

Road category	Road name	Type of project/development	Assessment criteria	
			Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Mid Western Highway	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{eq\ 15hr}$ 60 (external)	$L_{eq\ 9hr}$ 55 (external)
Local roads	Dungeon Road	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{eq\ 1hr}$ 55 (external)	$L_{eq\ 1hr}$ 50 (external)

Additionally, the RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to +2 dB.

In accordance with Section 2.4 of the RNP, any significant increase in total traffic noise at sensitive receivers must also be considered. Sensitive receivers experiencing increases in total traffic noise levels above those presented in Table 10.10 should be considered for mitigation.

Table 10.10 Relative road traffic noise increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase – dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{eq(15\ hr)}$+12 dB (external)	Existing traffic $L_{eq(9\ hr)}$+12 dB (external)

10.4.8 Blasting

Blasting for the mine development will operate within the overpressure and ground vibration limits outlined in *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC 1990), which are provided in Table 10.11.

Table 10.11 Blasting emissions criteria

Receiver	Airblast overpressure dBz Peak	Ground vibration mm/s	Allowable exceedance
Any residences on privately owned land	120	10	0%
	115	5	5 % of the total number of blasts over a period of 12 months

The cosmetic damage criteria are based on safe limit values outlined in *DIN 4150 Vibration in Buildings – Part 3: Effects in Vibration on Structures* (German Institute for Standardisation 2015) and is provided in Table 10.12. This is the vibration velocity in millimetres per second (mm/s) that a particular structure can withstand without cosmetic damage.

Table 10.12 Structural damage safe limit values

Line	Type of structure	Vibration velocity in mm/s			
		Foundation vibration frequency			Plane of floor of uppermost storey at all frequencies
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Sensitive buildings: structures that because of their particular sensitivity to vibration do not correspond to those listed in lines 1 or 2 and have intrinsic value (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

10.5 Reasonable and feasible mitigation measures

Preliminary noise modelling was undertaken to predict noise levels at surrounding residences associated with the initial mine design and waste rock emplacement schedule and the use of standard equipment. Early calculations identified that noise emissions had the potential to significantly exceed the PNTLs in the Kings Plains, Sturgeon Hill and Walkom Road noise catchments.

As a result, several changes to the project design and the incorporation of reasonable and feasible mitigation measures were considered to achieve an effective noise reduction at sensitive receptors, particularly during the early operational phase (Year 1 to Year 2) where the open cut pit will be relatively shallow and there will be limited opportunity for shielding of equipment on the waste rock emplacement.

Analysis of initial noise predictions showed that the significant contributors to noise levels in Kings Plains were the construction of the waste rock emplacement and the movement of haul trucks, particularly as they exited the open cut pit. Subsequently, significant work was undertaken to redesign the construction of the waste rock emplacement to minimise noise levels on the residents in Kings Plains. The initial design that was considered involved constructing the northern end of the emplacement first and dumping waste rock progressively south. Whilst this was an efficient way to construct the emplacement particularly in terms of haulage distances, the lack of shielding of equipment in this design meant noise emissions would easily propagate south towards Kings Plains.

The emplacement schedule was then re-configured so that dumping of waste rock would commence in the south, building the southern face of the bund first (ie the 'southern amenity bund', as shown in Figure 2.1) and as quickly as possible so that this could act as a bund behind which equipment could work as the dump progresses north throughout the rest of the mine life. A second amenity bund was then added to the design immediately south of the pit exit point to shield the noise from trucks exiting the pit (the 'pit amenity bund', as shown in Figure 2.1).

The construction of these two amenity bunds in the initial stages of the mine development resulted in significant improvements to the predicted noise levels at the nearest sensitive receivers, particularly after the bunds were constructed (from about Year 3 onwards). The bunds also serve the dual purpose of providing an effective visual barrier, as discussed in Chapter 19.

Some further investigation was carried out to address the noise levels associated with the amenity bund construction and early open cut pit development, which the model was predicting would still be high, especially during the evening and night-time periods. Acceptable noise levels were achieved during these periods through an iterative process of reducing equipment numbers in the pit until the pit reaches a depth of approximately 100 m (850 m RL) and reducing truck haulage (by approximately 60% of the daytime fleet) and the use of wheeled dozers rather than tracked dozers on the waste rock emplacement.

The two amenity bunds are planned to be completed as quickly as possible between Year 1 and Year 4 to provide noise and visual barriers for the remainder of mining operations. The time it will take to construct these bunds is dependent on the occurrence of non-noise enhancing meteorological conditions which would allow for their construction during the evening and night-time periods. Preliminary noise modelling has shown that there is potential for exceedances of the PNTLs during the construction of the bunds in noise enhancing meteorological periods. However, with a reduced in-pit fleet, shielded day and night dump locations, reduced haulage and real time noise monitoring (refer Section 10.7), operations will be managed to maintain compliance with the relevant PNTLs. A comparison of the daytime and night time (indicative) equipment numbers and operating times are presented in Table 10.13. Depending on these factors, the southern amenity bund and the pit amenity bund could be completed as early as halfway through Year 3 or the end of Year 4 (RL 1000 m). After this time the waste rock emplacement will progress to the north, and mobile equipment will be operational behind the southern amenity bund.

Table 10.13 Daytime, evening and night time mining fleet – Year 1 to Year 4

Equipment/ Fleet	Daytime	Evening and Night time
Prestrip/Rehabilitation fleet	7 am to 6 pm	Not Operating
Mining Fleet		
Primary Excavator	3	2
Secondary Excavator	1	Not Operating
Primary & Secondary haul truck	75 movements per hour	48 movements per hour
Water Cart	2	Not Operating
Tracked Dozer	3 (2 pit, 1 WRE[1])	Not Operating
Wheel Dozer	2 (1 pit, 1 WRE)	2 (1 pit, 1 WRE)
Grader	2	Not Operating
Production Drill	4	1
Ancillary Drill	2	Not Operating

Notes: 1. Waste rock emplacement

In addition to these changes to the mine design and scheduling, noise suppression equipment was also applied to trucks, excavator and drills in the noise model.

A summary of the reasonable and reasonable noise mitigation measures incorporated into the project design is as follows:

- application of noise suppression to key mobile equipment (ie trucks, excavators and drills) so that the noise envelope remains consistent with that presented in the NVIA;
- enclosure of the primary crusher in the ROM pad;
- construction of two noise barriers – the 'pit amenity bund' and the 'southern amenity bund' of the waste rock emplacement. Following their construction, the bunds will serve as noise and visual barriers between mining operations and receivers in Kings Plains;
- reduced mining operations during Year 1 to Year 4 for the evening and night-time periods during the construction of the 'pit amenity bund' and the 'southern amenity bund' as follows:
  - a reduced in-pit fleet (2 x excavators; 1 x drill; 1 x wheel dozer) until the pit reaches a depth of approximately 100 m (RL 850 m);
  - reduced haulage (approximately 60% reduction) from the pit to the ROM and the pit to the waste rock emplacement until the completion of the amenity bunds; and
  - tracked dozers only to operate during the daytime period, with wheeled dozers to be used during the evening and night-time periods.
- waste rock will always be dumped behind a barrier (except for bund lifts). Mine scheduling will create protected dump locations for night-time dump locations in the daytime to minimise noise emissions during the more sensitive night-time period.

The results of the noise model presented in Section 10.6 include these mitigation measures.

10.6 Impact assessment

10.6.1 Construction noise

i Modelling scenarios

As discussed in Chapter 2, mine construction activities will overlap with the operational phase. The construction scenario modelled in the noise assessment comprises the first six months of the project, essentially comprising site establishment, and includes the following main activities:

- construction of the temporary site access via Dungeon Road;
- commencement of construction of the permanent site access from the Mid Western Highway;
- clearing and grubbing of the open cut mine area; and
- clearing and grubbing of the ROM stockpile.

These site establishment activities will be undertaken predominately during the daytime only (ie standard construction hours of 7 am to 6 pm, as per the ICNG). For low intensity works during 'out-of-hours period' (OOH P1 – refer to Table 10.5), a sound power level of 119 dBA in the processing area has been used to represent the activities and equipment teams.

It was deemed appropriate to apply noise construction criteria during this period given that the activities to be undertaken will be limited to those that are considered to be 'construction'; that is equipment mobilisation, vegetation clearing and ground preparation, and the establishment of site access. Traditional activities that could be considered 'mining,' such as the dumping of rock on the waste rock emplacement and ore processing, will not commence in these first six months. Whilst ore processing will not start until during the second year of the mine development, operational criteria has conservatively been applied from month 7 in the first year onwards. This is because from this point on, activities on site will be undertaken 24 hours per day, and work will commence on the southern face of the waste rock emplacement to form the amenity bund.

Construction of other mine infrastructure such as the TSF, water management facilities, processing, crushing and screening plant, administration buildings, maintenance areas, haul roads, bunds and hardstand areas will continue to progress after the initial site establishment phase, when activities in the mine project area begin to be undertaken during the day, evening and night time periods, and are included as part of the operational noise assessment.

ii Predicted noise levels

Predicted construction noise levels for Month 1 to Month 6 in Year 1 are provided in Table 10.14. This includes a range of predicted construction noise levels at sensitive receivers during standard day time hours (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sunday or public holidays).

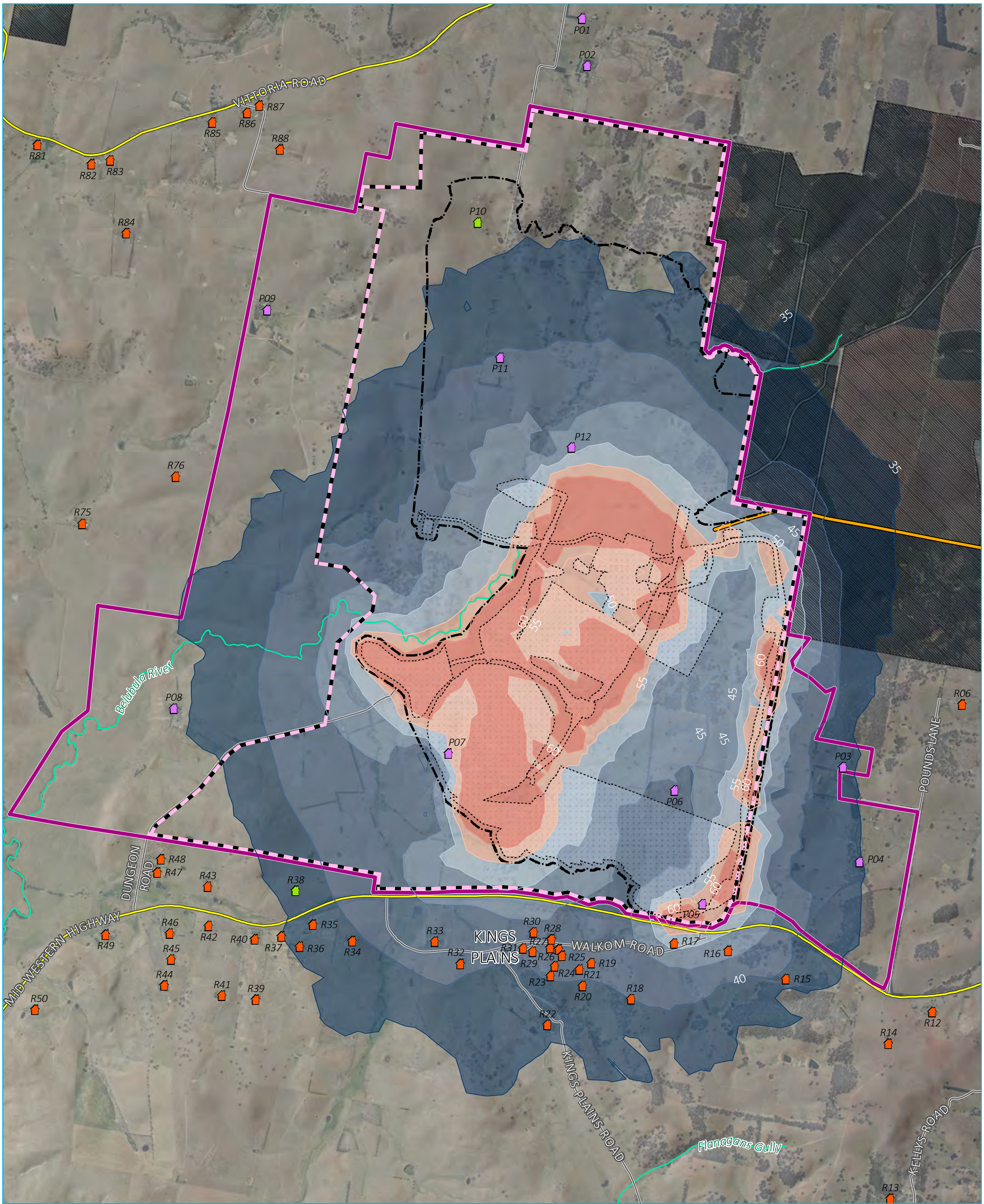
Table 10.14 Predicted day time construction noise levels – Year 1 Month 1 to Month 6

Catchment and receiver ID	NML dB $LA_{eq(15\ min)}$	PNL range dB $L_{Aeq(15\ min)}$	Receivers > NML
Distant Rural R1 to R14 and R52 to R88	45	21-34	Nil
Kings Plains R15 to R17 and R25 to R33	46	36-51	R17 (51 dB(A))
Walkom Road R18 to R24	45	36-44	Nil
Sturgeon Hill R34 to R51	45	22-42	Nil

Note: Receiver height is 1.5 above ground level.

Daytime noise levels during the initial six month construction period are predicted to comply with the relevant NMLs at all residential receivers, except for R17. A maximum level of 51 dB(A) is predicted at R17, which represents an exceedance of the NML by 5 dB. This predicted exceedance is caused by the construction of the new site access from the Mid Western Highway, which is in close proximity to R17 and will be a temporary activity.

For the proposed works during OOH P1, predicted noise levels are less than 35dB $LAeq_{(15min)}$ at all receivers, satisfying the relevant NMLs.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

KEY

Mine development project area (2,513.47 ha)

Disturbance footprint

Mining lease application area (1,812.99 ha)

Pipeline corridor

Mine development general arrangement - Year 1

Sensitive receptor

Private

Residences under option

Project related (Regis-owned)

Existing environment

Main road

Local road

Named watercourse

Vittoria State Forest

Day period noise level contour

35 dB(A)

40 dB(A)

45 dB(A)

50 dB(A)

55 dB(A)

60 dB(A)

Day period noise level contour range

35 - 39 dB(A)

40 - 44 dB(A)

45 - 49 dB(A)

50 - 54 dB(A)

55 - 59 dB(A)

60 - 64 dB(A)

Predicted noise level contours - construction phase

McPhillamys Gold Project
Environmental impact statement
Figure 10.2

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10.6.2 Operational noise

i Modelling scenarios

Operational noise modelling scenarios include construction and operation activities proposed during Month 7 to Month 12 in Year 1, Year 2 to 3, Year 4 to 7 and Year 8 to 10. The activities proposed and modelled in each scenario are as follows:

- **Year 1 (Month 7 to Month 12)** - activities include the ongoing construction of the main access road on the south-eastern boundary of the mine project area off the Mid Western Highway, removing topsoil and initial development of the pit (approximately 925 m RL), amenity bunds, haul roads and the waste rock emplacement.

- **Year 2 to Year 3** – commissioning of the processing plant and other infrastructure is anticipated to be completed by around Year 1.5. In this scenario, open cut mining operations to approximately 875 m RL and the southern face or 'front' of the waste rock emplacement is anticipated to be completed allowing rehabilitation to continue to enable restoration of the grassed and treed hillside.

  As described in Section 10.6, construction of the southern amenity bund and the pit amenity bund are planned to be completed as quickly as possible between Year 1 and Year 4 to provide noise and visual barriers for the remainder of mining operations. The time it will take to construct these bunds is dependent on the occurrence of non-noise enhancing meteorological conditions which would allow for their construction during the evening and night-time periods. The results presented are for calm conditions, as per the NPfI and the discussion on weather conditions provided in Section 10.3.3.

- **Year 4 to Year 7** – continued open cut mining operations to approximately 755 m RL, progression of the waste rock emplacement to the north and expansion of the TSF.

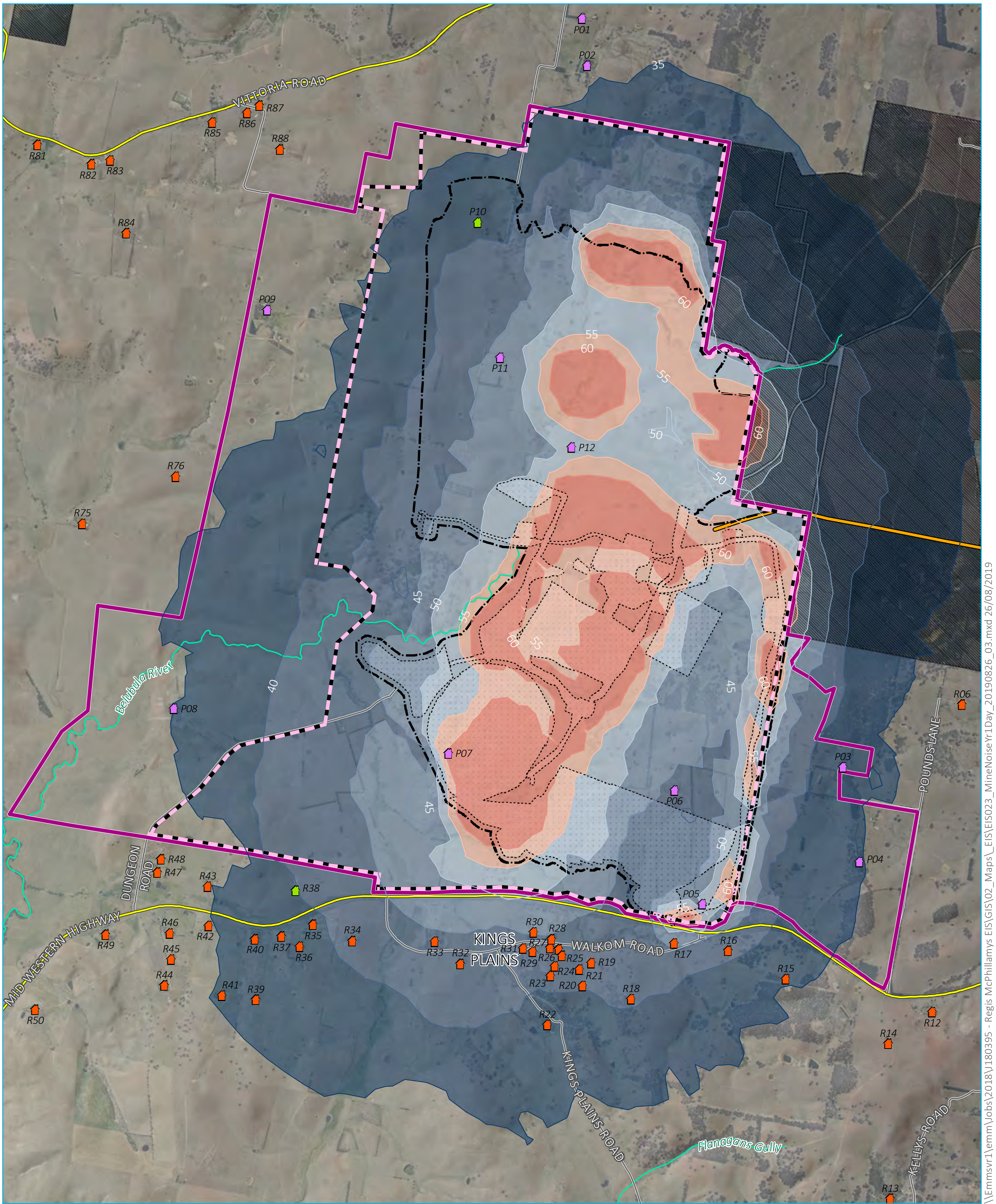
- **Year 8 to Year 10** - continued open cut mining operations to approximately 460 m RL, finalisation and rehabilitation of the waste rock emplacement, and expansion and capping of the TSF.

The scenarios modelled are as per the staged mine plans presented in Chapter 2 (Figures 2.4a-2.4d).

ii Predicted operational noise levels

Noise levels predicted for the scenarios described above in Year 1, Year 2, Year 4 and Year 8 are provided in Table 10.15. Results are presented as a range for each catchment together with the number of receivers that exceed the PNTLs by up to 2dB and up to 5dB. Results include a low frequency noise penalty (+2dBA) for those receivers where applicable. As shown, no receivers are predicted to experience noise levels greater than 5 dB above the PNTL with the mitigation measures described in Section 10.5 in place.

Predicted noise contours for the day and night time periods for the four progressive mine stages modelled are presented in Figures 10.3 – 10.10.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km
GDA 1994 MGA Zone 55
N

KEY

Mine development project area (2,513.47 ha)
Disturbance footprint
Mining lease application area (1,812.99 ha)
Pipeline corridor
Mine development general arrangement - Year 1

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

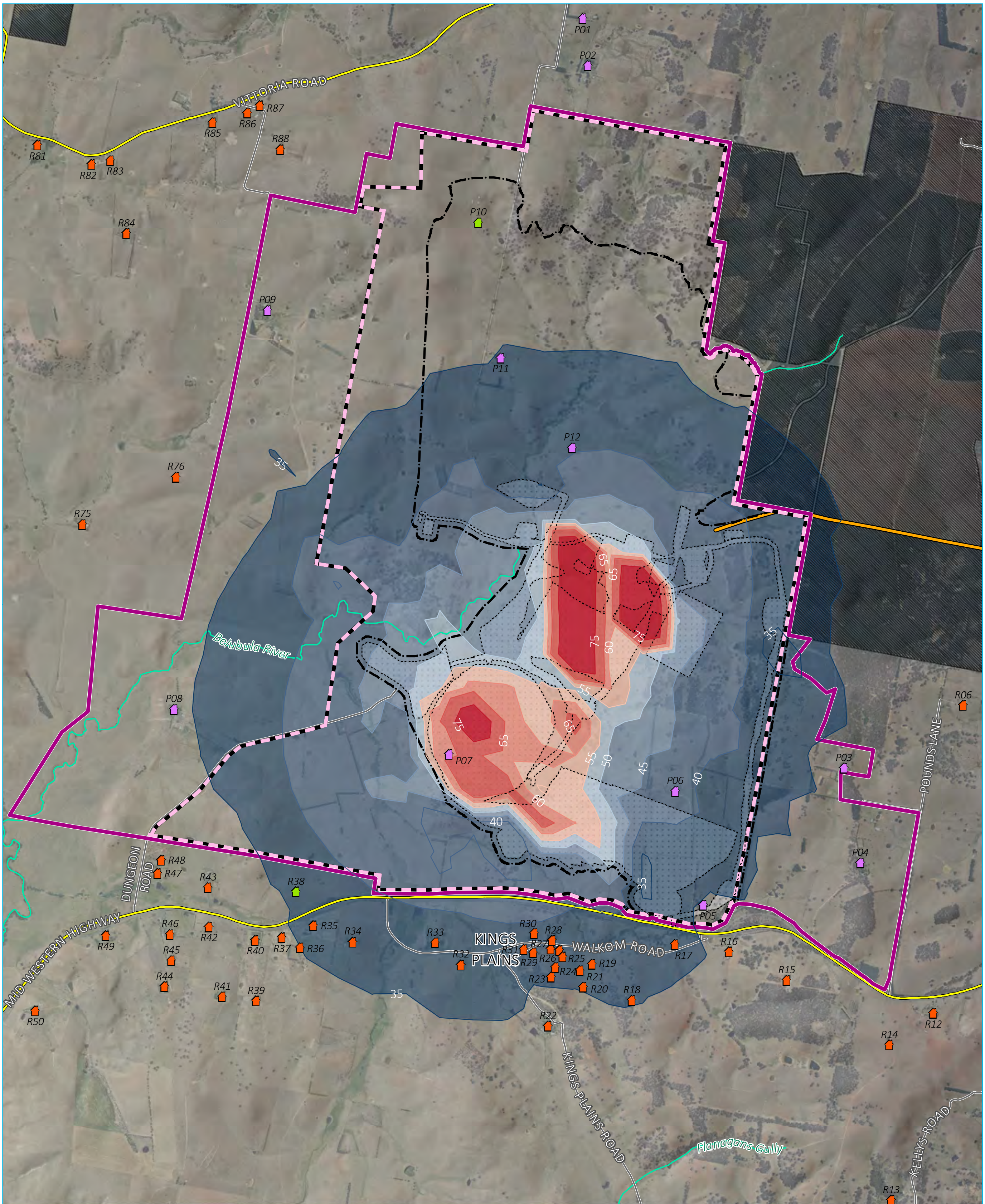
Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Day period noise level contour
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)

Day period noise level contour range
- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)

Predicted noise level contours - operations - Yr 1 day period

McPhillamys Gold Project
Environmental impact statement
Figure 10.3



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

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KEY

Mine development project area (2,513.47 ha)

Disturbance footprint

Mining lease application area (1,812.99 ha)

Pipeline corridor

Mine development general arrangement - Year 1

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Night period noise level contour

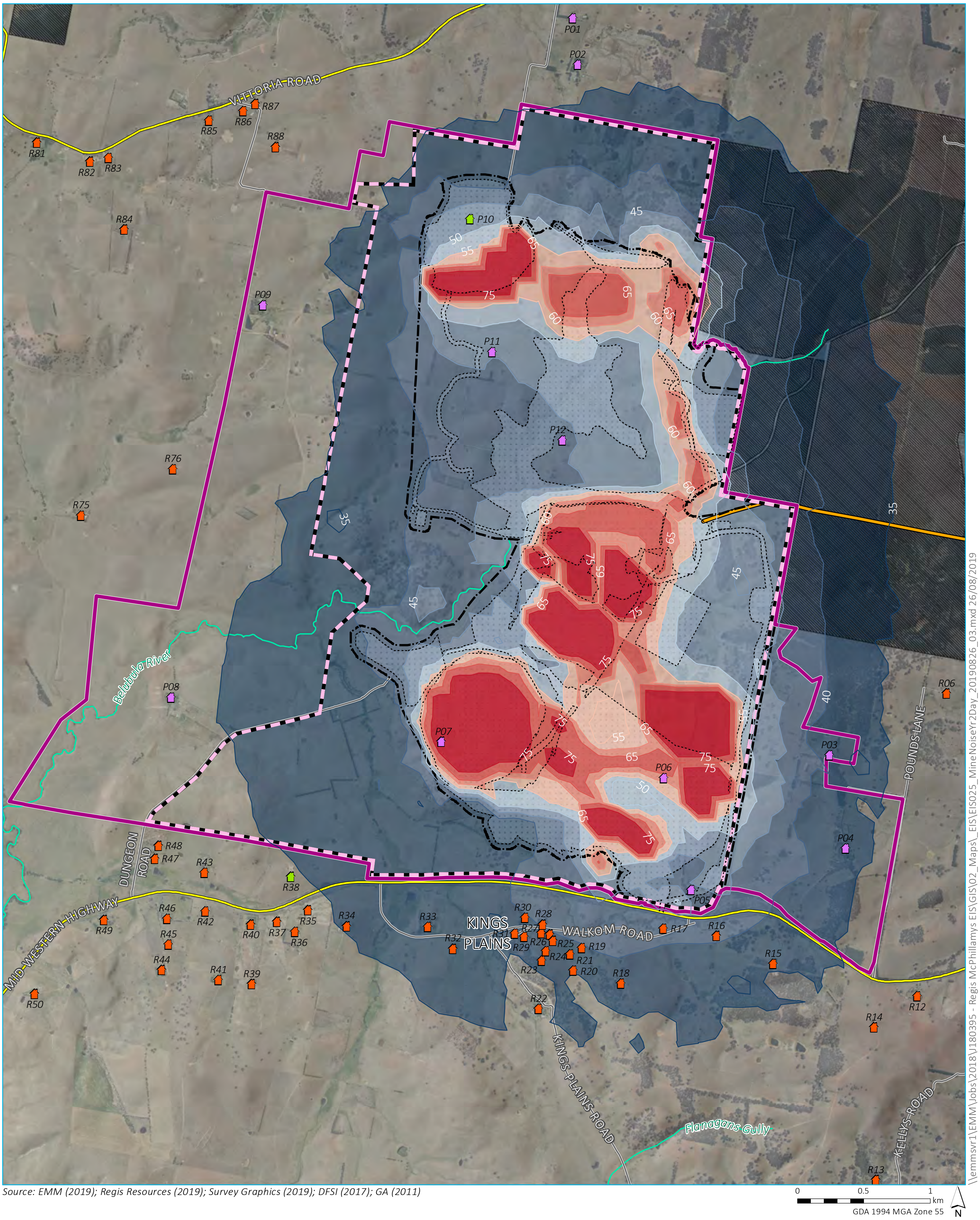
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)
- 65 dB(A)
- 75 dB(A)

Night period noise level contour range

- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)
- 65 - 74 dB(A)
- 75 + dB(A)

Predicted noise level contours - operations - Yr 1 night time period

McPhillamys Gold Project
Environmental impact statement
Figure 10.4



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

KEY

Mine development project area (2,513.47 ha)
Disturbance footprint
Mining lease application area (1,812.99 ha)
Pipeline corridor
Mine development general arrangement - Year 2

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

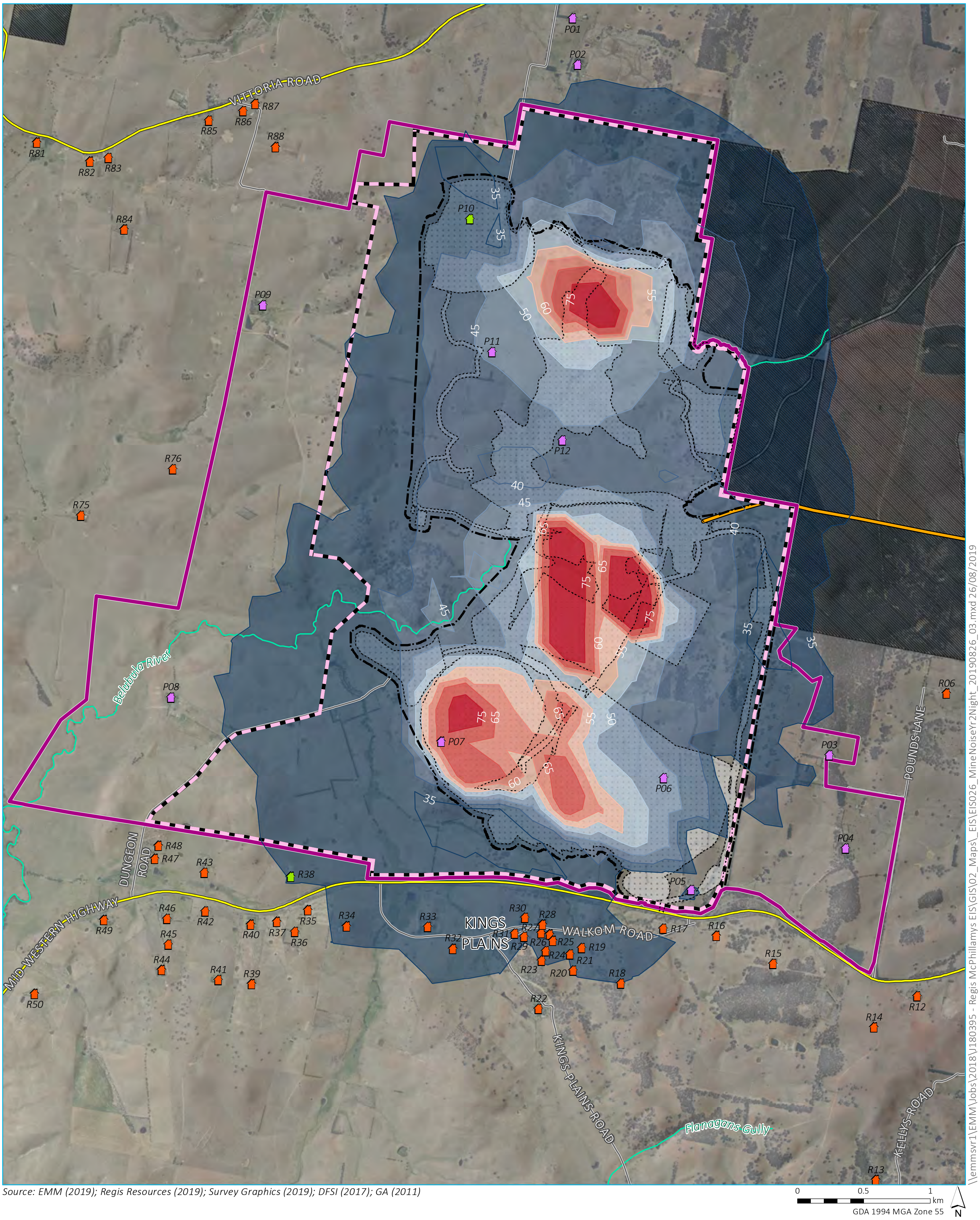
Day period noise level contour
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)
- 65 dB(A)
- 75 dB(A)

Day period noise level contour range
- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)
- 65 - 74 dB(A)
- 75 + dB(A)

Predicted noise level contours - operations - Yr 2 day period

McPhillamys Gold Project
Environmental impact statement
Figure 10.5

REGIS RESOURCES LTD
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

KEY

- Mine development project area (2,513.47 ha)
- Disturbance footprint
- Mining lease application area (1,812.99 ha)
- Pipeline corridor
- Mine development general arrangement - Year 2

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Night period noise level contour

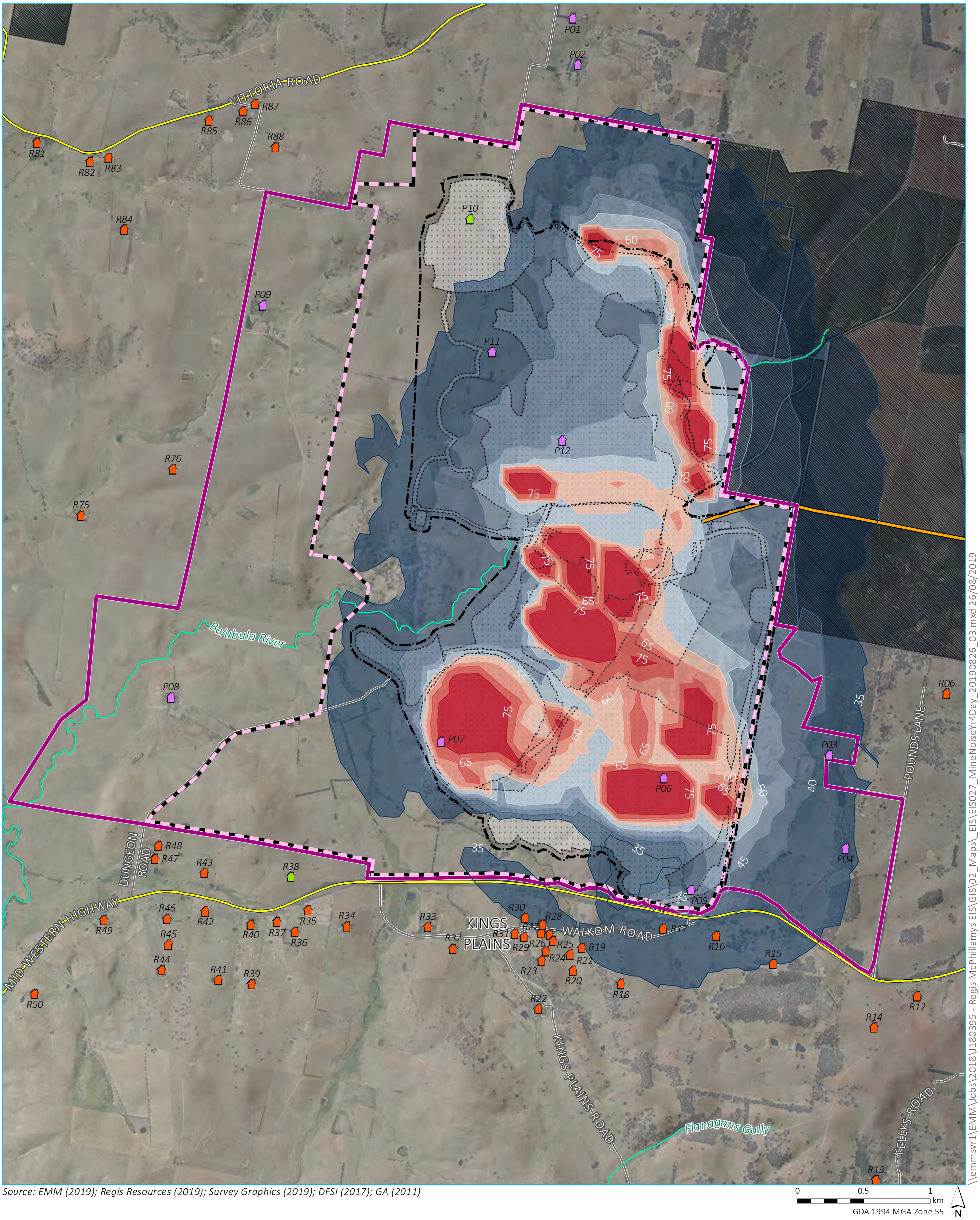
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)
- 65 dB(A)
- 75 dB(A)

Night period noise level contour range

- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)
- 65 - 74 dB(A)
- 75 + dB(A)

Predicted noise level contours - operations - Yr 2 night time period

McPhillamys Gold Project
Environmental impact statement
Figure 10.6



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

KEY

Mine development project area (2,513.47 ha)
Disturbance footprint
Mining lease application area (1,812.99 ha)
Pipeline corridor
Mine development general arrangement - Year 4

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

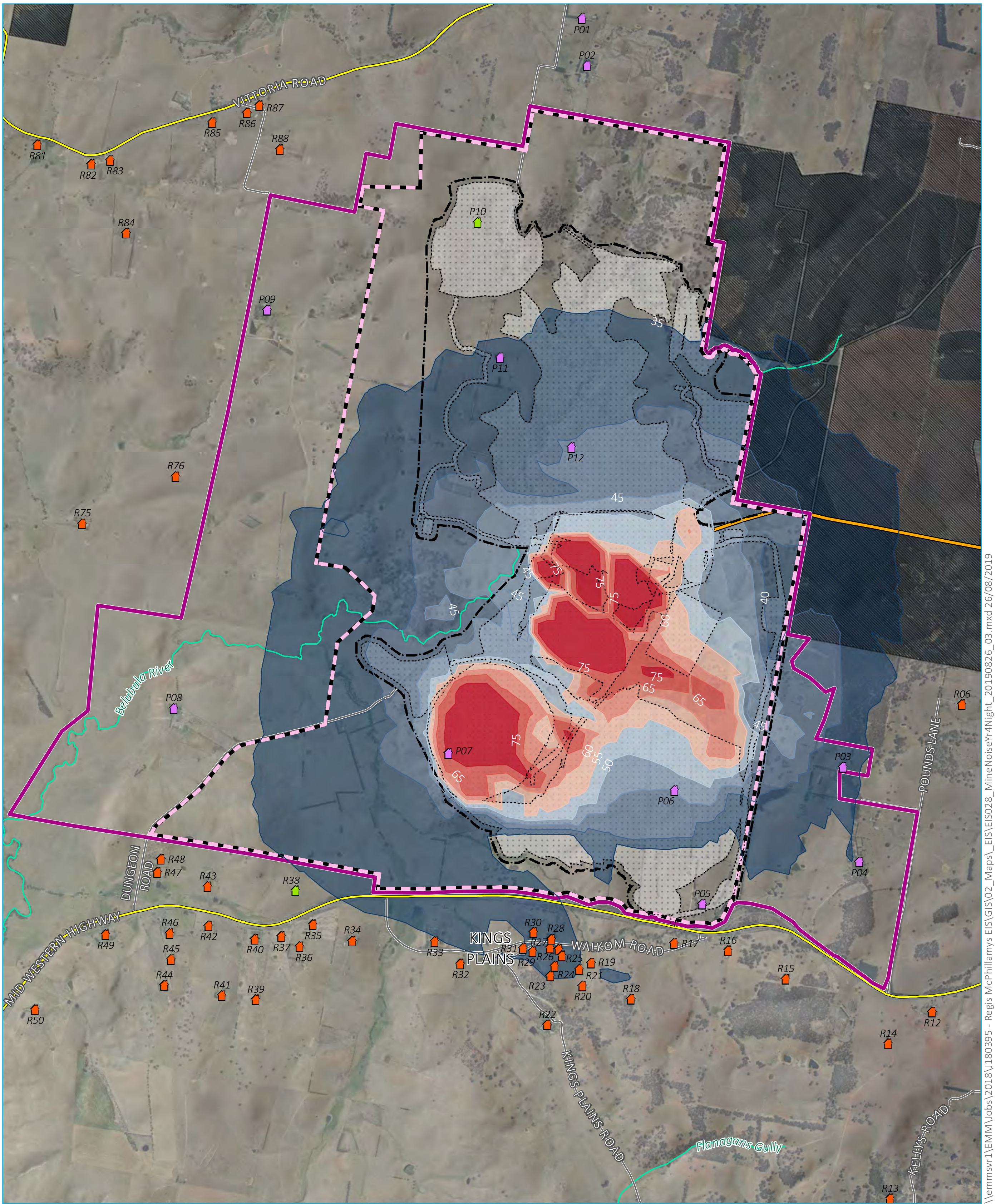
Day period noise level contour
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)
- 65 dB(A)
- 75 dB(A)

Day period noise level contour range
- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)
- 65 - 74 dB(A)
- 75 + dB(A)

Predicted noise level contours - operations - Yr 4 day period

McPhillamys Gold Project
Environmental impact statement
Figure 10.7

REGIS RESOURCES LTD
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km
GDA 1994 MGA Zone 55
N

KEY

Mine development project area (2,513.47 ha)
Disturbance footprint
Mining lease application area (1,812.99 ha)
Pipeline corridor
Mine development general arrangement - Year 4

Sensitive receptor
Private
Residences under option
Project related (Regis-owned)

Existing environment
Main road
Local road
Named watercourse
Vittoria State Forest

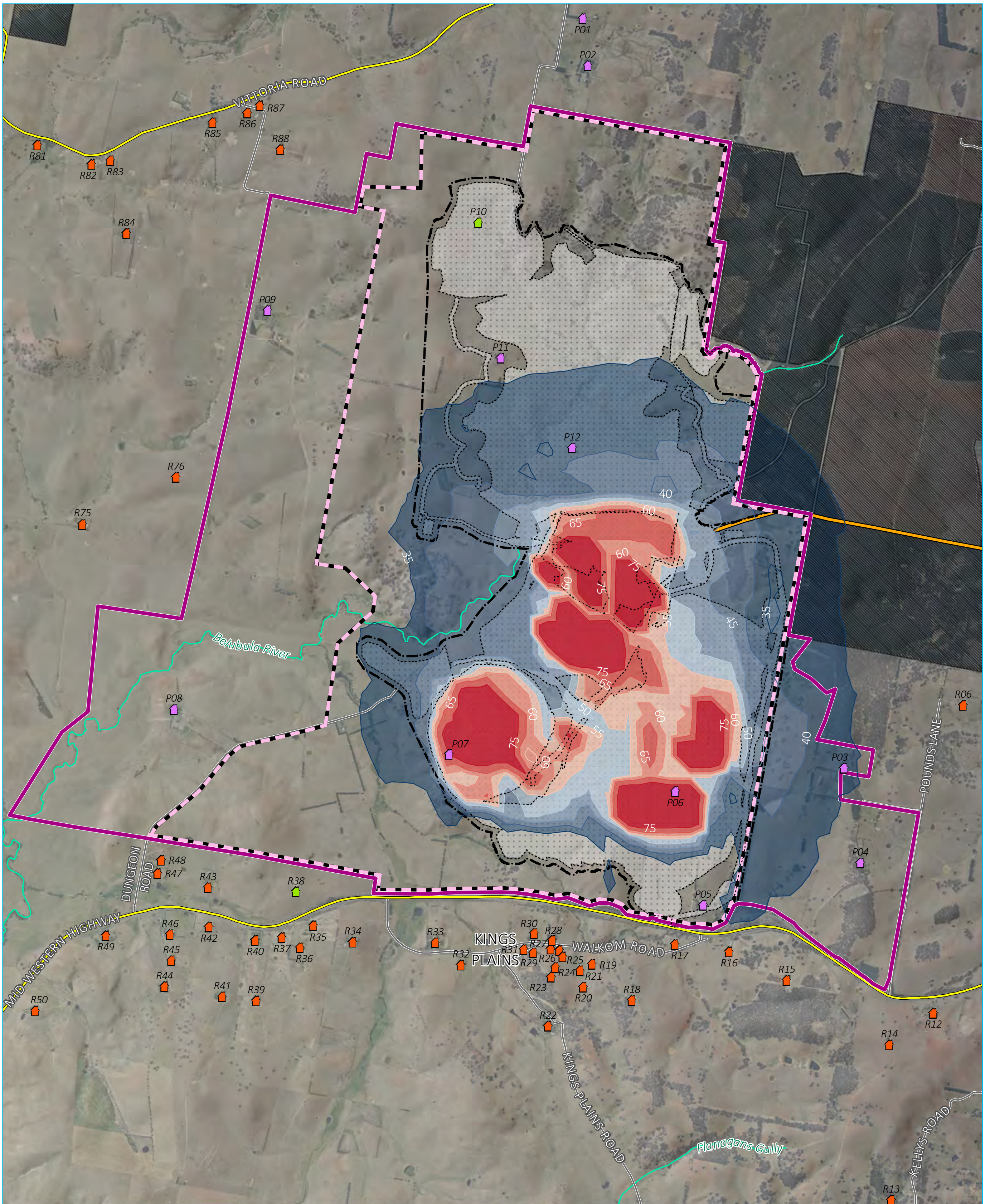
Night period noise level contour
35 dB(A)
40 dB(A)
45 dB(A)
50 dB(A)
55 dB(A)
60 dB(A)
65 dB(A)
75 dB(A)

Night period noise level contour range
35 - 39 dB(A)
40 - 44 dB(A)
45 - 49 dB(A)
50 - 54 dB(A)
55 - 59 dB(A)
60 - 64 dB(A)
65 - 74 dB(A)
75 + dB(A)

Predicted noise level contours - operations - Yr 4 night time period

McPhillamys Gold Project
Environmental impact statement
Figure 10.8

REGIS RESOURCES LTD
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

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KEY

Mine development project area (2,513.47 ha)

Disturbance footprint

Mining lease application area (1,812.99 ha)

Pipeline corridor

Mine development general arrangement - Year 8

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Day period noise level contour

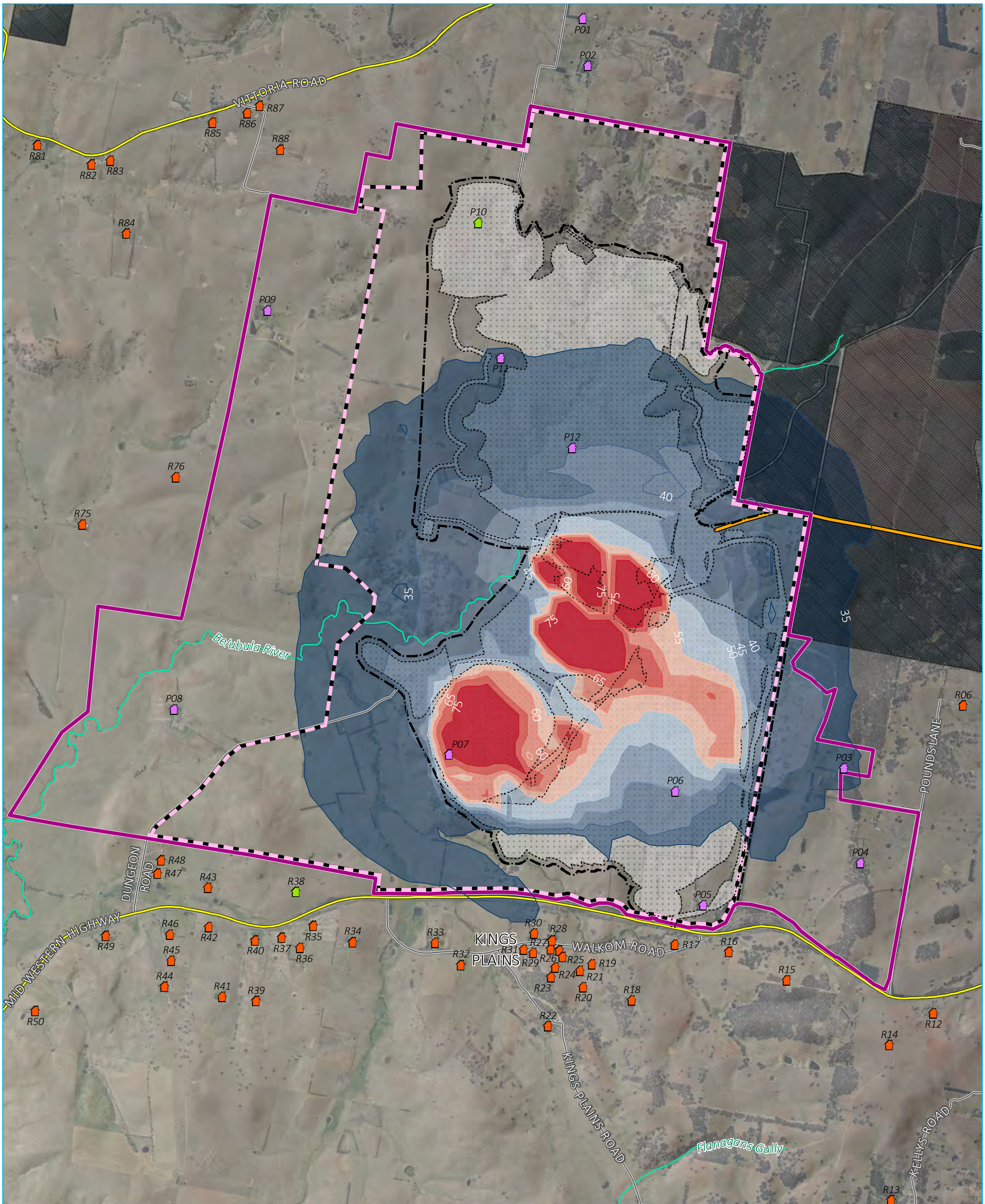
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)
- 65 dB(A)
- 75 dB(A)

Day period noise level contour range

- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)
- 65 - 74 dB(A)
- 75 + dB(A)

Predicted noise level contours - operations - Yr 8 day period

McPhillamys Gold Project
Environmental impact statement
Figure 10.9



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

KEY

Mine development project area (2,513.47 ha)

Disturbance footprint

Mining lease application area (1,812.99 ha)

Pipeline corridor

Mine development general arrangement - Year 8

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Night period noise level contour

- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- 60 dB(A)
- 65 dB(A)
- 75 dB(A)

Night period noise level contour range

- 35 - 39 dB(A)
- 40 - 44 dB(A)
- 45 - 49 dB(A)
- 50 - 54 dB(A)
- 55 - 59 dB(A)
- 60 - 64 dB(A)
- 65 - 74 dB(A)
- 75 + dB(A)

Predicted noise level contours - operations - Yr 8 night time period

McPhillamys Gold Project
Environmental impact statement
Figure 10.10

Table 10.15 Predicted operational mine development noise levels

Catchment (No)[1] Receiver ID	Period[1]	PNTL, dB LAeq(15min)	Predicted noise level range dB LAeq(15min)				No. of receivers where: Exceedance of PNTL by up to 2dB[2]				No. of receivers were: Exceedance of PNTL by more than 2dB but less than 5dB			
			Yr 1	Yr 2	Yr 4	Yr 8	Yr 1	Yr 2	Yr 4	Yr 8	Yr 1	Yr 2	Yr 4	Yr 8
Distant Rural (51)	Day	**40**	26-34	24-33	19-32	18-30	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
R01 – R14, R52 - R88	Evening	**35**	19-31	21-33	20-32	19-33	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Night	**35**	21-31	21-33	20-32	19-31	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Kings Plains (12)	Day	**41**	36-45	37-41	33-38	31-34	**2**	Nil	Nil	Nil	**9**	Nil	Nil	Nil
R15-R17, R25-R33	Evening	**36**	32-37	32-37	32-36	32-35	**9**	**7**	Nil	Nil	**1**	Nil	Nil	Nil
	Night	**35**	32-37	32-37	32-36	31-35	**2**	**3**	**6**	Nil	**9**	**6**	Nil	Nil
Walkom Road (7)	Day	**40**	38-44	35-40	30-35	29-34	**2**	Nil	Nil	Nil	**3**	Nil	Nil	Nil
R18-R24	Evening	**35**	30-36	32-36	30-35	30-35	**2**	**4**	Nil	Nil	**4**	Nil	Nil	Nil
	Night	**35**	30-36	32-36	30-35	23-34	**2**	**4**	Nil	Nil	**4**	Nil	Nil	Nil
Sturgeon Hill (18)	Day	**40**	27-42	26-37	23-31	19-30	**2**[4]	Nil	Nil	Nil	Nil	Nil	Nil	Nil
R34-R51	Evening	**38**	23-36	25-36	25-34	21-33	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Night	**35**	23-36	25-36	25-34	22-33	**1**	**2**	Nil	Nil	**2**	**1**	Nil	Nil

Note 1: Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening – the period from 6pm to 10pm; Night – the remaining periods.

Note 2: Exceedance of the PNTL by less than 2dB is considered negligible as per VLAMP significance assessment.

Note 3: These receivers are in the noise management zone but do not exceed the PNTL by more than 5dB.

Note 4: Includes R38 – Regis has an option to purchase R38 on receipt of project approval.

Based on the results presented in Table 10.15, a summary of the total number of privately owned residences predicted to experience exceedances of the PNTLs over the operational project life is as follows:

- 20 privately owned houses in the Kings Plains locality will experience up to a 2 dB exceedance of the PNTL:
  - 11 in Kings Plains catchment- R16, R17, R25, R26, R27, R28, R29, R30, R31, R32, R33;
  - 6 in the Walkom Road catchment – R18, R19, R20, R21, R23, R24; and
  - 3 in the Sturgeon Hill catchment – R34, R38, R36.
- 15 privately owned houses in the Kings Plains locality, plus one for which Regis have an option to purchase subject to obtaining project approval (R38), will experience exceedances of the PNTL by greater than 2 dB, but less than 5 dB, and will therefore be entitled to voluntary mitigation upon request:
  - 10 in the Kings Plains catchment – R17, R25, R26, R27, R28, R29, R30, R31, R32, R33;
  - 4 in the Walkom Road catchment – R19, R21, R23, R24; and
  - 2 in the Sturgeon Hill ctachment – R34 and R38.

A summary of when these exceedances will occur by project years, is as follows.

<u>Project Year 1 (from Month 7 onwards)</u>

- Noise levels are expected to exceed the PNTLs by 1- 2dB (ie negligble residual noise levels) at:
  - 10 receivers in the Kings Plains catchment;
  - 3 receivers in the Walkom Road catchment; and
  - 3 receivers in the Sturgeon Hill catchment.
- Noise levels are expected to exceed the PNTLs by btween 3-5 dB at the following receivers, who will therefore be entitled to voluntary mitigation upon request in accordance with the VLAMP;
  - 10 receivers in the Kings Plains catchment;
  - 4 receivers in the Walkom Road catchment; and
  - 2 receivers in the Sturgeon Hill catchment.

Alternatively, Regis may enter into an agreement with these landholders. These negotiations have commenced with some landholders.

<u>Project Year 2</u>

- Receivers predicted to experience a negligble increase in noise levels (ie 1- 2dB above the PNTLs) are:
  - 9 receivers in the Kings Plains catchment;
  - 4 receivers in the Walkom Road catchment; and

- 2 receivers in the Sturgeon Hill catchment.

- Noise levels are expected to exceed the PNTLs by btween 3-5 dB at the following receivers, who will therefore be entitled to voluntary mitigation upon request in accordance with the VLAMP;
  - 6 receivers in the Kings Plains catchment; and
  - 1 receiver in the Sturgeon Hill catchment (this is R38 which, as noted previously, Regis has an option to purchase).

Project Year 4

During Year 4 noise levels are expected to exceed the PNTLs by up to 2 dB at six receivers in the Kings Plains catchment (R26, R27, R28, R29, R30, R31) during the night time. Noise levels are not expected to exceed the PNTLs more than 2 dB at any receiver during any period.

Project Year 8

No exceedances are predicted.

A summary of the receptors where exceedances are predicted is provided in Table 10.16 and 10.17. The receptors that will be entitled to voluntary mitigation measures upon request, in accordacne with the VLAMP, are illustrated in Figure 10.11.

Table 10.16 Receivers where project noise levels exceed PNTL by up to 2dB

Catchment (No. of receivers) Receiver ID	Period	Year 1	Year 2	Year 4	Year 8
Kings Plains (12) R15-R17, R25-R33	Day	R16, R32 (2)	Nil	Nil	Nil
	Evening	R17, R25, R26, R27, R28, R29, R31, R32, R33 (9)	R27-R33 (7)	Nil	Nil
	Night	R16-R17 (2)	R25, R26, R30 (3)	R26, R27, R28, R29, R30, R31 (6)	Nil
Walkom Road (7) R18-R24	Day	R20, R21 (2)	Nil	Nil	Nil
	Evening	R18, R20 (2)	R19, R21, R23, R24 (4)	Nil	Nil
	Night	R18, R20 (2)	R19, R21, R23, R24 (4)	Nil	Nil
Sturgeon Hill (18) R34-R51	Day	R34, R38 (2)	Nil	Nil	Nil
	Evening	Nil	Nil	Nil	Nil
	Night	R36 (1)	R34, R36 (2)	Nil	Nil

Table 10.17 Receivers where project noise levels exceed PNTL by more than 2dB and less than 5 dB

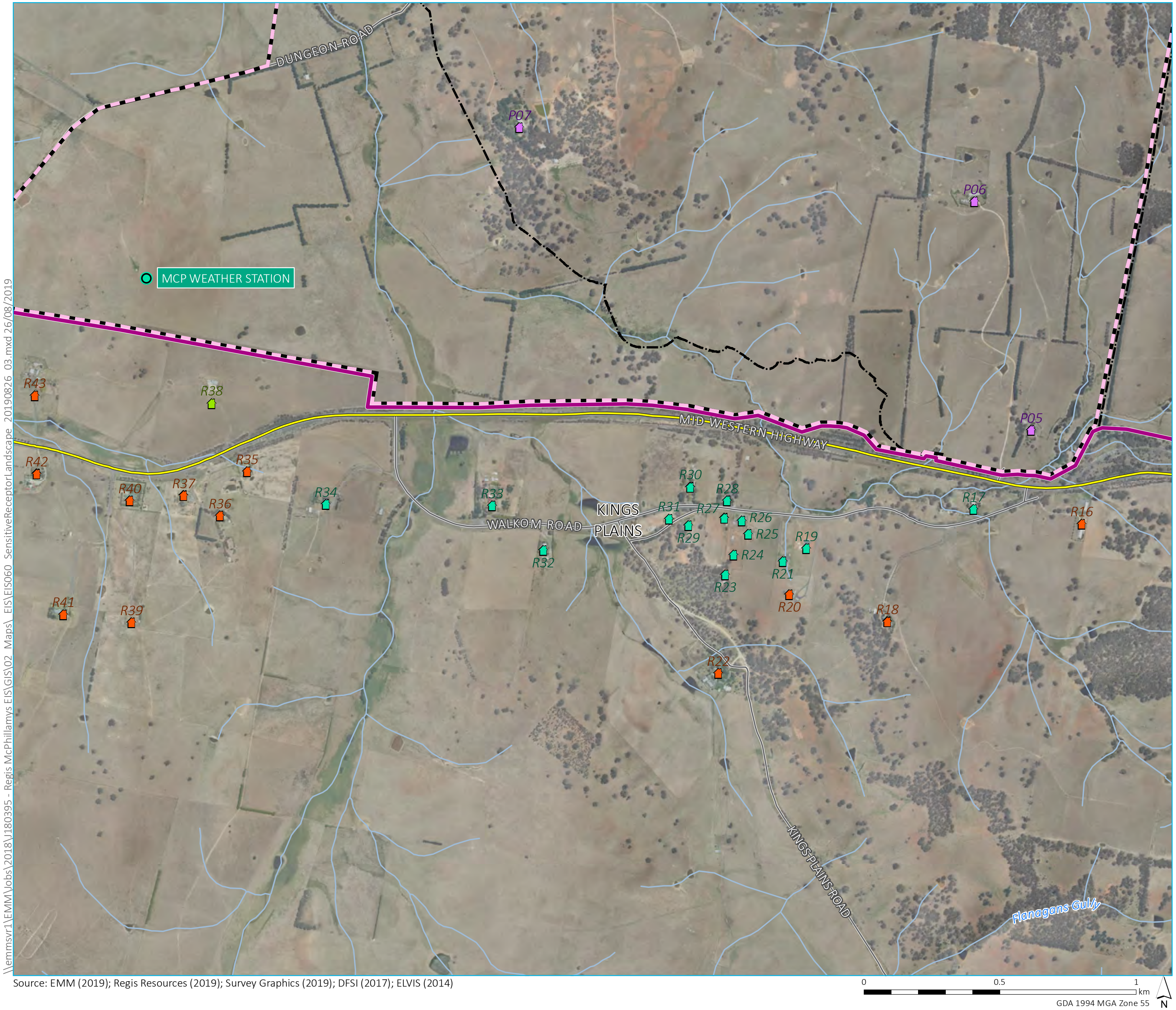
Catchment (No. of receivers) Receiver ID	Period	PY1	PY2	PY4	PY8
Kings Plains (12) R15-R17, R25-R33	Day	R17, R25, R26, R27, R28, R29, R30, R31, R33 (9)	Nil	Nil	Nil
	Evening	R30 (1)	Nil	Nil	Nil
	Night	R25-R33 (9)	R27, R28, R29, R31, R32, R33 (6)	Nil	Nil
Walkom Road (7) R18-R24	Day	R19, R23, R24 (3)	Nil	Nil	Nil
	Evening	R19, R21, R23, R24 (4)	Nil	Nil	Nil
	Night	R19, R21, R23, R24 (4)	Nil	Nil	Nil
Sturgeon Hill (18) R34-R51	All	Nil	Nil	Nil	Nil

Note: Receivers are in the noise management zone but do not exceed the PNTL by more than 5dB.

As shown, predicted daytime noise levels during Year 1 and Year 2 are expected to exceed the PNTLs by up to 5 dB. For the same period, predicted noise levels for evening and night time operations are generally below PNTL +2 dB, but do not exceed the PNTLs by more than 5 dB.

Importantly, these noise levels:

- are of a temporary nature (Year 1 to Year 4);
- decrease over time; and
- can be managed accordingly in conjunction with the appropriate monitoring system and management controls described in Section 10.5 and Section 10.7.



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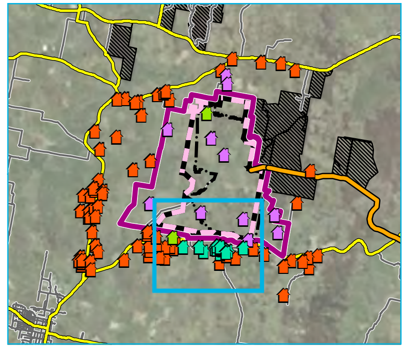


KEY

- Weather station
- Sensitive receptor
  - Project related (Regis-owned)
  - Residences under option
  - Sensitive receptor (private)
  - Sensitive receptor (private) entitled to voluntary noise mitigation
- Project application area
  - Mine development project area (2,513.47 ha)
  - Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
  - Disturbance footprint
  - Pipeline corridor
- Existing environment
  - Main road
  - Local road
  - Watercourse/drainage line
  - Vittoria State Forest

Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

Sensitive receivers entitled to voluntary noise mitigation

McPhillamys Gold Project
Environmental impact statement
Figure 10.11

REGIS RESOURCES LTD EMM creating opportunities

iii Sleep disturbance

As provided in Table 10.18, the predicted operational noise levels during the night period do not exceed the maximum noise level criteria, and therefore a detailed maximum noise level assessment is not required.

Table 10.18 Predicted maximum noise levels

Catchment and receiver ID	Maximum noise level screening criteria		PNL range							
			Year 1		Year 2		Year 4		Year 8	
	$L_{Aeq(15\ min)}$	L_{AMAX}	$L_{Aeq(15\ min)}$	L_{AMAX}	$L_{Aeq(15\ min)}$	L_{AMAX}	$L_{Aeq(15\ min)}$	L_{AMAX}	$L_{Aeq(15\ min)}$	L_{AMAX}
Distant Rural R1 to R14 and R52 to R88	40	52	21-31	34	21-33	34	20-32	34	19-31	34
Kings Plains R15 to R17 and R25 to R33	40	52	32-37	42	32-37	43	32-36	41	31-35	41
Walkom Road R18 to R24	40	52	30-36	39	32-36	41	30-35	39	29-34	39
Sturgeon Hill R34 to R51	40	52	23-36	31	25-36	32	25-34	30	22-33	29

iv Low frequency noise

An analysis of C weighted minus A weighted values was undertaken to assess whether any impacts relating to low frequency noise need to be accounted for in the mine development. The results show that the difference between C weighted and A weighted noise levels is generally less than 15 dB for receivers within 2 km of the mine development, except for:

- 12 receivers in the Kings Plains catchment;
- 7 receivers in the Walkom Road catchment; and
- 18 receivers in the Sturgeon Hill catchment;

where the difference is up to 22 dB. This calculated difference is considered to be a negligible impact in accordance with the VLAMP and is likely to be imperceptible, as the absolute C weighted noise level is below 60 dB $LC_{eq(15min)}$ and is predominantly during the daytime during Year 1.

For receivers in the Distant Rural catchment, the difference between the A weighted and C weighted noise levels is generally greater than 15 dB but are no greater than 17 dB. Similarly, the calculated difference is considered as a negligible impact and is likely to be imperceptible, and the absolute C weighted noise level is below 60 dB $LC_{eq(15min)}$.

Notwithstanding, a +2 dB penalty has been applied to all receivers where the difference is greater than 15 dB for completeness, although the potential for low frequency noise impacts are considered unlikely.

10.6.3 Road traffic noise

As described in Chapter 2, construction traffic will initially use Dungeon Road to access the project area, until the new main site access is constructed off the Mid Western Highway, at which time a section of Dungeon Road will be closed. Road traffic noise was therefore predicted for the construction phase in accordance with the following scenarios:

- Year 1 (Month 1 to Month 6): project-related traffic on Dungeon Road; and
- Year 1 (Month 7 to Year 2 (Month 16)): project-related traffic using the Mid Western Highway.

The nearest residential receivers are approximately 60 m from Dungeon Road and 80 m from the Mid Western Highway.

In the context of the NVIA, construction was assessed for the first half of Year 1, as the NMLs for 24 hour/7 day construction are the same as for operations. However, in the context of road traffic, construction related traffic will be present through to around the middle of Year 2 in combination with operational traffic, after which time there will only be operational related road traffic.

The results of the road traffic noise assessment are presented in Table 10.19 and Table 10.20. As shown, predicted road traffic noise levels on Dungeon Road for the initial 6-month construction period will not exceed the relevant criteria. Once the Mid-Western Highway access is constructed, calculated noise levels are predicted to remain below the relevant criteria for both the daytime and night time assessment periods. In Year 1 road traffic noise is predicted to increase by more than 2 dB; however, the overall level is within the criteria and the relative increase criteria. This increase is due to the combination of operational and construction road traffic. Notwithstanding, the project related road traffic noise levels satisfy the relevant RNP criteria.

Table 10.19 Road traffic noise levels at Dungeon Road

Project phase	Traffic volume	Assessment criteria for day period $L_{Aeq(1\ hour)}$	Predicted noise level for day period $L_{Aeq(period)}$
PY 1 Month 1 to Month 6 (construction)	25 light vehicles per hour 20 heavy vehicles per hour	55	49.5

Table 10.20 Road traffic noise levels at Mid Western Highway

Road	Project phase	Assessment criteria		Predicted road traffic noise level dB $LA_{eq(period)}$	
		Day $L_{Aeq(15\ hour)}$	Night $L_{Aeq(9\ hour)}$	Day	Night
Mid Western Highway	Existing	-	-	46.0	43.4
	Yr 1 Month 1 to Month 6 (construction)	60	55	46.6	44.4
	Yr 1 Month 7 to Yr 2	60	55	46.7	48.8
	Yr 2 to Yr 8	60	55	46.6	44.4

10.6.4 Blasting

Predicted blasting emissions, including air blast overpressure and ground vibration, at nearby residential receivers and heritage items are provided in Table 10.21 for blasts up to 300 kg maximum instantaneous charge (MIC). These values are predicted to remain within the blasting emissions criteria provided in Table 10.11 and will not impact nearby infrastructure, like the Mid Western Highway, or listed heritage buildings in Kings Plains (refer to Chapter 16). In relation to livestock, blast effects resulting from the mine development are predicted to be, at worst for overpressure up to 115 dBZ, and for vibration between 0.1 mm/s and 1.3 mm/s. These levels are well below the regulatory criteria and considerably lower than other sources of overpressure that horses or livestock are likely to be already subjected to such as lightning strikes which are typically between 120dBZ and 130dBZ[4].

Table 10.21 Blasting emissions

Sensitive receiver ID or heritage item number	Distance to charge (m)	Airblast overpressure (dBZ Peak)	Ground vibration (mm/s)
I205 R6	3527	101	0.2
R16	2204	107	0.5
R17	1858	109	0.6
I201 R26	1365	113	1.1
I208 R28	1288	114	1.2
R29	1327	113	1.1
R30	1194	115	1.3
R31	1287	114	1.2
I202 R32	1383	113	1.0

[4] Equine Health Impact Statement – Drayton South Coal Project (2015)

Table 10.21 Blasting emissions

Sensitive receiver ID or heritage item number	Distance to charge (m)	Airblast overpressure (dBZ Peak)	Ground vibration (mm/s)
I206 R33	1263	114	1.2
R34	1552	111	0.9
R35	1670	110	0.8
R38	1630	111	0.8
I203 R49	3020	103	0.3
I204 R51	5084	96	0.1
R75	3529	101	0.2
R76	3202	102	0.3

10.7 Management and mitigation

10.7.1 Overview

As described in Section 10.5, the project design considered and incorporated all reasonable and feasible mitigation measures to minimise operational noise and vibration impacts on residential receivers, as follows:

- noise suppression devices on key mobile equipment (trucks, excavators and drills);
- enclosure of the primary crusher in the ROM pad;
- construction of two noise barriers as quickly as possible in the initial stages of the mine development; the pit amenity bund and the southern amenity bund;
- reduced operations in the night and evening time periods during construction of the amenity bunds;
- reduced use of equipment and haulage in the project area during construction of the amenity bunds; and
- dumping of waste rock behind noise barriers at all times, with the exception of bund lifts.

It is also noted that the amenity bunds will serve as both noise and visual barriers between the mine development and residential receivers in Kings Plains.

The construction of the southern face of the waste rock emplacement and the pit amenity bund will require careful management based on predicted weather conditions. Where weather conditions will be such that the PNTLs cannot be achieved during the evening and night-time periods due to the close proximity to Kings Plains, operations will be scheduled to take place in the northern end of the emplacement during those periods.

10.7.2 Operational noise

In addition, to the reasonable and feasible measures discussed above, Regis will install a real-time noise monitoring system to measure and report live operational noise levels. This system will enable proactive management of operations to ensure that the relevant noise criteria is met during all time periods.

The noise monitoring program will monitor both meteorological conditions and operational noise levels using a combination of unattended real time noise monitoring terminals and operator attended monitoring.

A noise management plan (NMP) will also be prepared for both the construction and operational phases of the project. The NMP will detail the noise monitoring program and also a complaints handling procedure to ensure queries relating to noise are recorded and effectively responded to.

10.7.3 Construction noise

Construction will occur within the standard construction hours and out of hours periods provided in Table 10.5, except for the construction of amenity bunds. As per Table 10.14, noise levels during construction have the potential to exceed the NML at R17 by 5 dB.

The following general management and mitigation measures will be implemented during the construction phase of the project:

- ensure construction activities meet NMLs for standard construction hours and out of hours periods provided in Table 10.5 as far as practicable;
- where feasible avoid undertaking construction activities adjacent to residential receivers between 6 pm to 7 am;
- for residential receivers that are predicted to experience exceeded NMLs (R17), implement reasonable and feasible noise controls to minimise noise emissions;
- adopt alternative measures to minimise impact on the community if noise control measures do not adequately address any exceedances; and
- implementation of management and mitigation measures noted in AS2436-2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites* if reasonable and feasible.

In addition to mitigation measures noted above, the methods to manage construction noise will be detailed in the CEMP that will address noise and vibration management and mitigation options (where required). The plan will be completed before construction and will describe how construction noise levels will be managed where predicted noise levels exceed NMLs.

10.7.4 Blasting

Management and mitigation measures to reduce air blast overpressure due to blasting are listed below:

- designing the blast to reduce air blast overpressure, which could include the stemming of blast holes with appropriate packing material to contain explosive gasses, reduction of MIC by reducing the number of holes fired at any one time or reducing the amount of unconfined explosives product;
- completion of test blasts to validate predicted blasting emissions as provided in Table 10.21;
- blast monitoring conducted at various distances from the blast site; and

- maintenance of a blast monitoring log in consideration of AS2187.2-2006 *Explosives – Storage, Transport and Use – Appendix J*.

10.8 Conclusion

The mine design and indicative schedule for which approval is sought has been developed through an iterative process, largely in consideration of the outcomes of noise modelling for both contruction and operation of the mine. Given the close proximity of the mine project area to a number of residences, particularly in the Kings Plains locality, some key design changes were incorporated into the project where reasonable and feasible to do so, so that noise emissions can be managed effectively at these nearest sensitive receptors, and minimised as much as possible.

The initial development of the mine will include the construction of two amenity bunds at the southern end of the project area; the pit amenity bund, and the southern amenity bund, which is the southern face of the waste rock emplacement. The amenity bunds will be completed during Year 1 to Year 4 and serve as both noise and visual barriers between the mine development and residential receivers in Kings Plains. The time to construct these bunds will be dependant in part on weather conditions during their construction. Where noise enhancing conditions occur, particularly at night-time, operations may be limited on the southern face and will have to move to the northern end of the emplacement. Regis will proactively manage activities on these amenity bunds in consideration of real-time noise monitoring and weather conditions so that the bunds can be constructed as quickly as possible and in accordance with the noise predictions in the NVIA.

Notwithstanding, the operational noise asssessment identified that 15 residences will be entitled to the implemenation of voluntary mitigation measures upon request in Kings Plains due to predicted exceedances of the PNTLs in the first few years of the mine development. These residences are R17, R19, R21, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33 and R34 as shown in Figure 10.11. Alternatively, Regis may enter into an agreement with these landholders. Importantly, these exceedances will reduce to within 2 dB of the relevant PNTL by Year 4.

Another receptor, R38, was also identifed as being entitled to voluntary noise mitigation measures, bringing the number to 16; however, Regis have negotiated an option to purchase this property with the landholder, subject to obtaining development consent for the project.

The sleep disturbance assessment concluded that the predicted noise levels at the assessment locations will be well below those likely to cause awakenings.

Noise levels during the initial site establishment period are predicted to exceed the NML at one residential receptor, which is R17, by 5 dB(A). This is attributed to the construction of the new mine site intersection on the Mid Western Highway. Considering this, it is important to note that NMLs are not a criterion (as are operational noise limits), but a trigger for when construction noise management is to be considered and implemented. Construction management and mitigation measures will be detailed in the CEMP to be prepared for the mine development.

The MIC for blasts at the mine development will be limited to 300 kg. Under this scenario, no exceedances of the relevant criteria for air blast overpressure and ground vibration is predicted and any nearby residential receiver and heritage item.

Road traffic noise relating to vehicle movements on Dungeon Road and the Mid Western Highway are not predicted to exceed the assessment or relative increase criteria at any of the houses near these roads.

Chapter 11

Air quality

REGIS RESOURCES LTD

11 Air quality

11.1 Introduction

An assessment was undertaken to assess potential air quality impacts associated with the mine development on the surrounding environment, particularly at neighbouring sensitive receptors. This chapter summarises the air quality impact assessment (AQIA), with the full technical report attached in Appendix M.

Through an iterative process of modelling and design, a number of measures have been incorporated into the design of the mine development to specifically avoid, minimise and/or mitigate potential air quality impacts. These measures are described in this chapter, with some key measures including:

- chemical dust suppressants will be applied to all waste rock and ROM ore haulage routes between the pit exit and truck unloading point;
- the fine ore stockpile will be covered;
- the design of crushers, screens and associated transfer points at the processing circuit will include dust control, dust extraction and / or filter systems;
- all exposed conveyors in the processing circuit will be covered; and
- progressive rehabilitation will be undertaken throughout the mine life, particularly on the waste rock emplacement.

The AQIA identified additional mitigation and management measures to address residual impacts.

The results of the dispersion modelling show that emissions of particulate matter, gaseous pollutants, odour concentrations and dust deposition rates as a result of the mine development will be below applicable air quality impact assessment criteria, and small relative to existing ambient conditions.

The assessment was undertaken in accordance with the relevant EARs, which require an assessment of the likely air quality impacts of the mine development. The air quality related EARs are presented in Table 11.1.

Table11.1 Air quality related EARs for the mine development

Requirement	Location in report
Air quality – including:	
– an assessment of the likely air quality impacts of the development, including cumulative impacts from nearby developments, in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW, and having regard to the NSW Government's Voluntary Land Acquisition and Mitigation Policy; and	This chapter and the Air Quality Impact Assessment, (refer to Appendix M).
– an assessment of the likely greenhouse gas impacts of the development;	Chapter 12
– a description of the feasibility of measures that would be implemented to monitor and report on the emissions (including fugitive dust and greenhouse gases) of the development.	Section 11.5, and Chapter 12.

11.2 Existing environment

11.2.1 Nearest receptors

The land surrounding the mine project area features a number of scattered rural and rural-residential properties, with the highest density of houses (ie sensitive receptors) adjacent to the southern boundary of the project area in Kings Plains. The air quality assessment considered the same receptors as the noise assessment, which are illustrated in Figure 10.1 (refer to Chapter 10) and consist of 88 dwellings.

11.2.2 Meteorology

Meteorological conditions affect the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. Dust generation events are particularly dependent on wind regimes, rainfall, evaporation, atmospheric stability and depth of mixing in the lower atmosphere.

i Data sources

In order to characterise the dispersion meteorology of the project area and surrounds, data collected from an on-site weather station was used, as well as long-term climate records from a BoM weather station.

Regis maintains a meteorological monitoring station as part of its monitoring network within the project area, as shown in Figure 10.1. Data from this on-site station was the primary resource for representing weather conditions in and around the project area in the dispersion modelling.

This on-site data was supplemented with corresponding observations of station-level pressure and cloud cover from the BoM automatic weather station (AWS) at Orange Airport, 20 km north-west of the project area meteorological station.

The meteorological data recorded by the on-site station was analysed for the five-year period between 2014 and 2018 (refer to Appendix B of the AQIA report (Appendix M)). The analysis demonstrated a similarity across years in the most important parameters for pollutant dispersion, such as wind speed and wind direction. Air temperature and relative humidity results were also comparable from year to year between 2014 and 2017. The 2018 dataset showed slightly higher temperatures and lower relative humidity, which are indicative of the strong drought conditions during the year. Concentrations of particulate matter were also relatively high during 2018. Therefore, although the 2018 dataset represented the most recent calendar year, it was not considered to be representative of the area relative to the previous four years. Consequently, the 2017 calendar year was adopted as the 12-month modelling period for the purpose of the AQIA.

ii Wind speed and direction

A wind rose showing the wind speed and direction recorded at the on-site meteorological station during 2017 is presented in Figure 11.1. The winds recorded by the on-site station across all five years were predominately easterly and westerly winds, with a minor north-westerly component. Recorded wind speeds show a high proportion of elevated wind (greater than 5.5 m/s) across all years, while the frequency of calm conditions (wind speeds less than 0.5 m/s) occurred less than 0.2% of the time.

Seasonal and diurnal wind roses for the on-site meteorological station during 2017 are provided in Figure 11.2 and Figure 11.3 respectively. The seasonal variation in wind speed was minor; however, there was a noticeable seasonal variation in wind direction, with the easterly component most prevalent between spring and early autumn, and winds from the west being most dominant during winter.

Wind speed and wind direction varied on a diurnal basis. The night-time hours featured a higher proportion of easterly winds, while westerly winds were more evident during the daytime. The wind speeds at night were slightly lower on average than during the daytime, with average wind speeds of 6.4 m/s during the day and 5.4 m/s during the night.

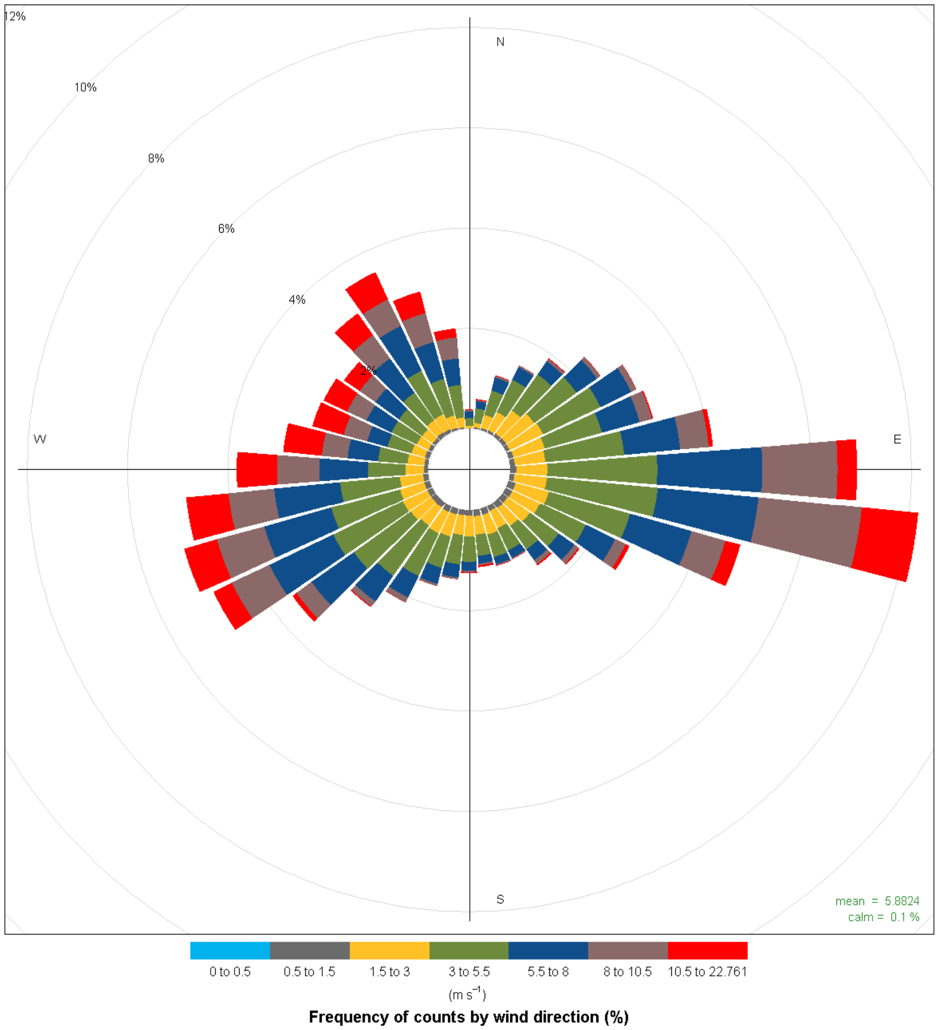


Figure 11.1 Recorded wind speed and direction – on-site meteorological station – 2017

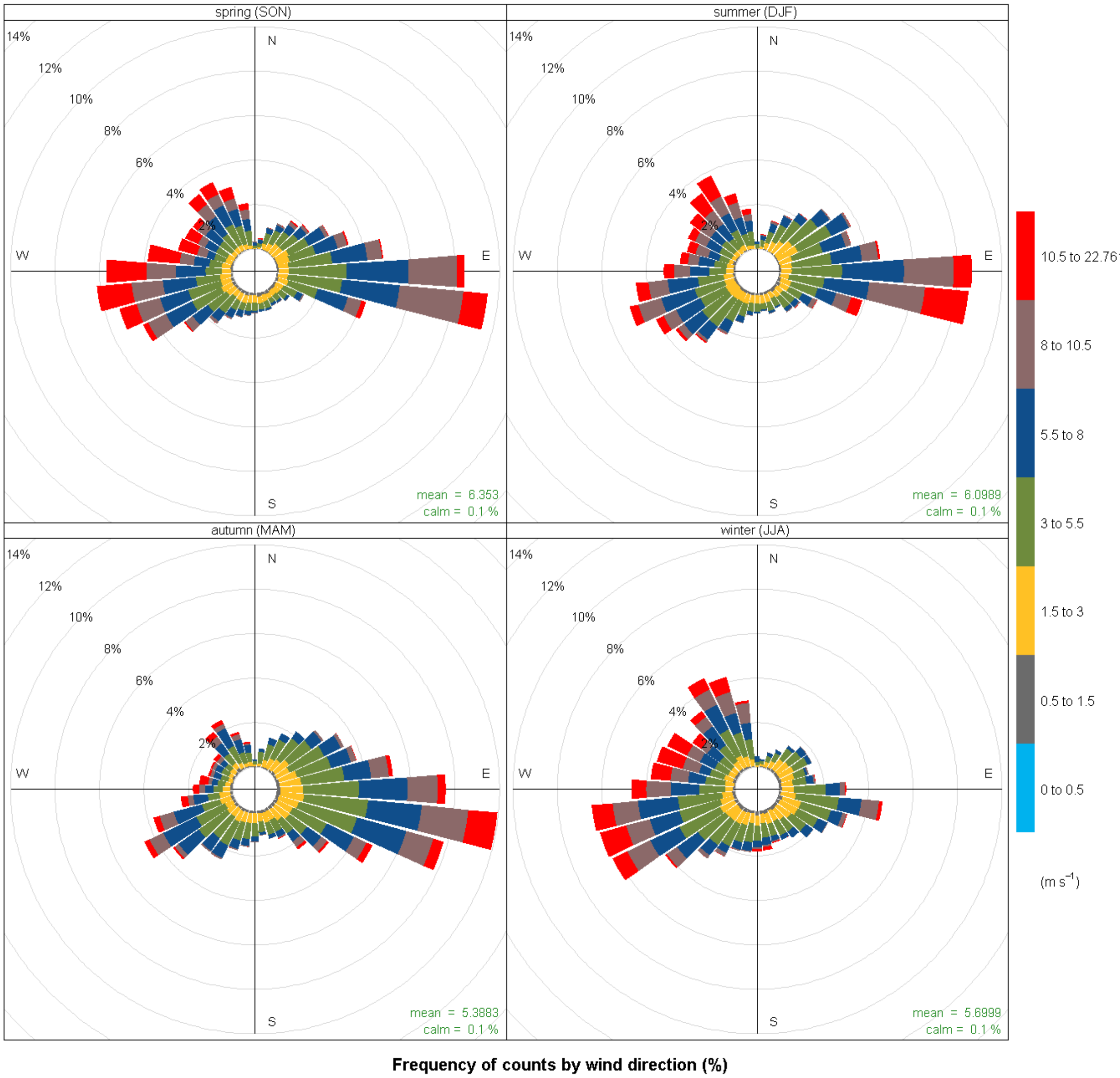


Figure 11.2 Seasonal wind speed and direction – on-site meteorological station – 2017

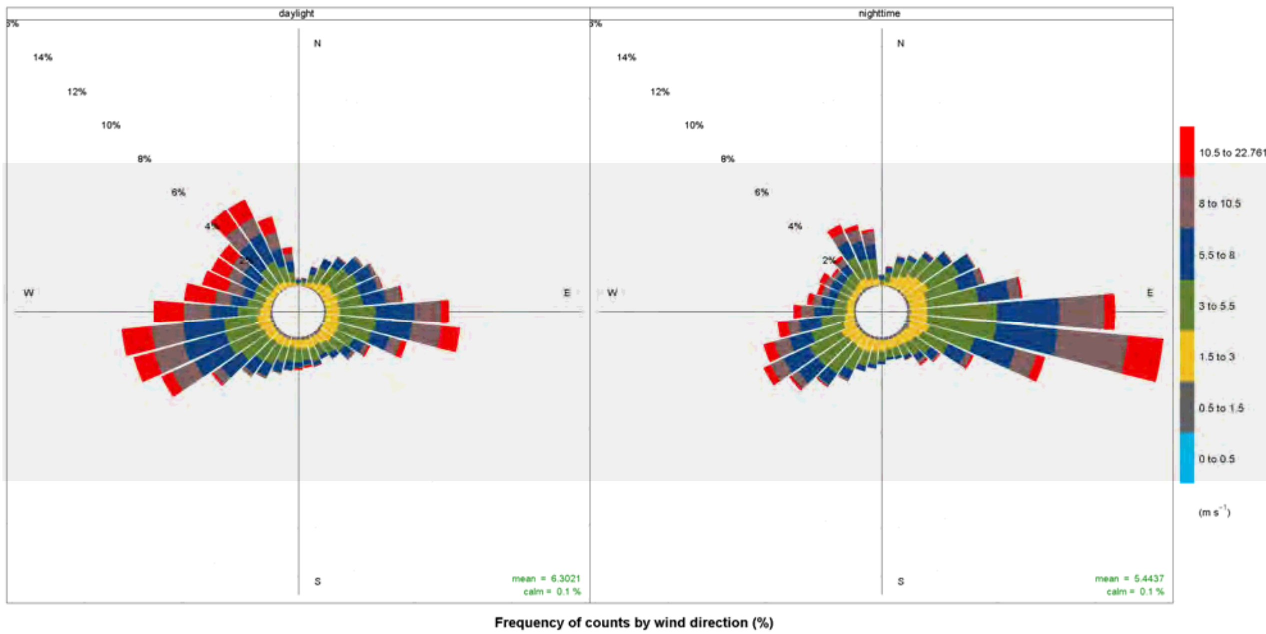


Figure 11.3 Diurnal wind speed and direction – on-site meteorological station – 2017

11.2.3 Existing sources of emissions

The National Pollutant Inventory (NPI) and EPA environment protection licence database have been reviewed to identify significant existing sources of air pollutants in the local region. Three premises were listed in Blayney (the Nestle Purina factory, Cadia Valley Operations dewatering facility, and a gas pipeline metering station), approximately 6-8 km to the south-west of the project area. Given the size of these facilities and the distances involved, associated emissions would not cause direct cumulative impacts with potential mine-related emissions.

It is considered that, given the lack of industrial and extractive operations in the region surrounding the project area, the main contributing non-project related sources of air pollutant emissions to baseline air quality in the vicinity of the mine development include:

- dust from vehicle movements along unsealed and sealed town and rural roads with high silt loadings;
- dust emissions from agricultural activities at neighbouring properties;
- fuel combustion-related emissions from on-road and non-road engines;
- wind generated dust from exposed areas within the surrounding region;
- seasonal emissions from household wood burning; and
- episodic emissions from vegetation fires.

More remote sources which contribute episodically to suspended particulates in the region include dust storms and bushfires. The above emission sources are accounted for in the monitoring data analysed as part of the AQIA.

11.2.4 Air quality monitoring data resources

Regis has commissioned an air quality monitoring network for the project area. The network consists of the following monitoring equipment:

- one high-volume air sampler (HVAS) for the recording of PM_{10} concentrations on a one-in-six day routine;
- four dust deposition gauges for recording monthly dust deposition rates; and
- one meteorological station recording weather conditions, including wind speed and direction, temperature, solar radiation, rainfall and atmospheric pressure.

The locations of the air quality monitoring equipment are illustrated in Figure 11.4. Data collected over four years from these monitoring stations was used to characterise the existing air quality environment in the dispersion modelling for the mine development.

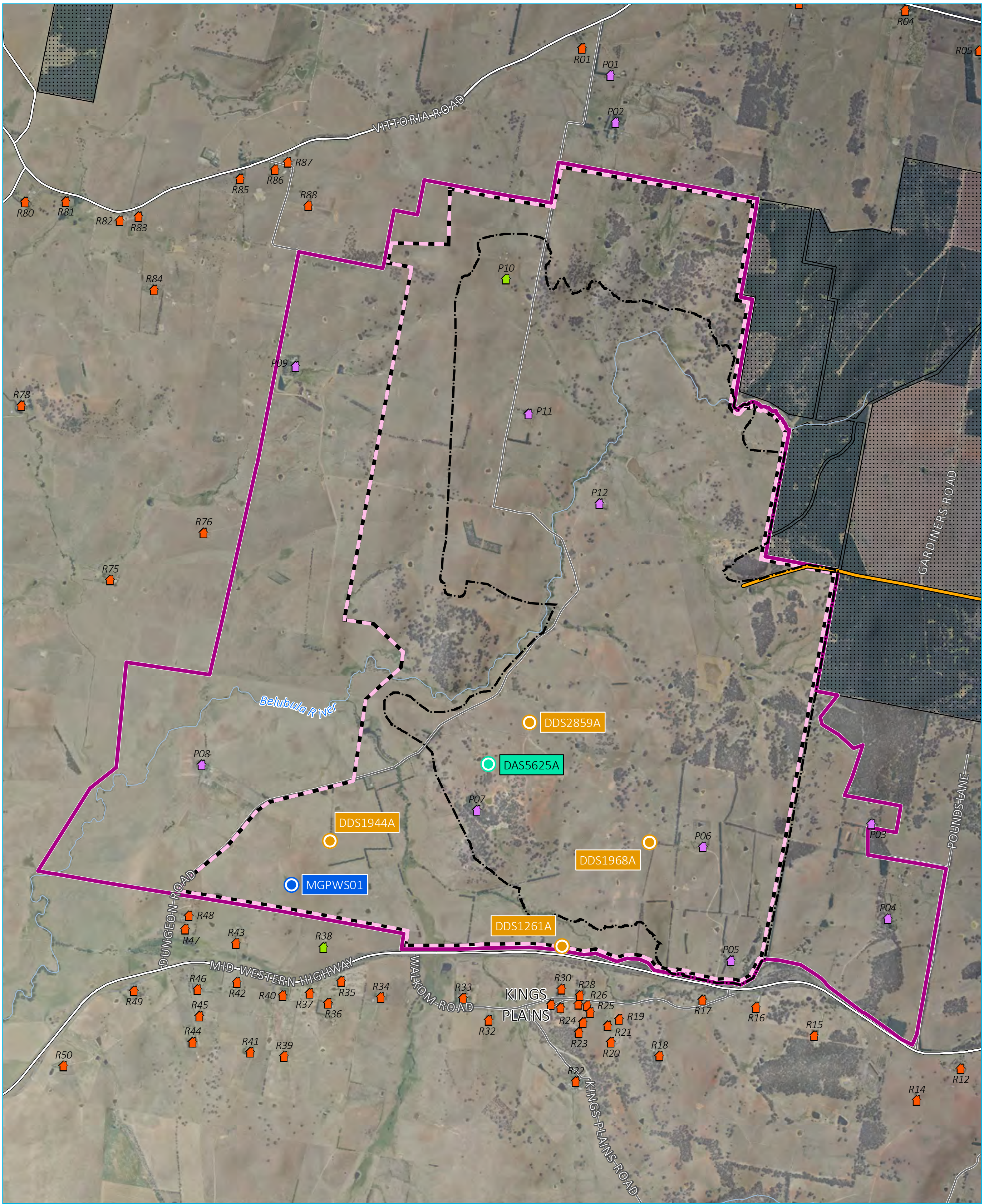
To supplement the project-specific monitoring data, hourly average concentrations of PM_{10} and $PM_{2.5}$ for the period 2014-2018 were obtained from the DPIE Biodiversity and Conservation Division (BCD, formally OEH) air quality monitoring station at Bathurst, approximately 23 km east-north-east of the project area.

11.2.5 Adopted background summary

A summary of the background air quality conditions in and around the project area, as derived from the data sources described above, is as follows:

- annual average total suspended particulates (TSP) – 35.3 µg/m^3, derived from the annual average PM_{10} concentration from both the on-site HVAS and the BCD Bathurst dataset in 2017;
- 24-hour PM_{10} – daily varying concentrations, derived from a combination of one-in-six day measurements from the on-site HVAS monitoring station and continuous measurements from the BCD Bathurst station during 2017. Concentrations range from 3.0 µg/m^{3}to 49.9 µg/m^3;
- annual average PM_{10} – 14.1 µg/m^3, combined from the on-site HVAS and BCD Bathurst AQS results in 2017;
- 24-hour $PM_{2.5}$ – daily varying concentrations from the BCD Bathurst station during 2017. Concentrations range from 1.4 µg/m^{3}to 17.5 µg/m^3;
- annual average $PM_{2.5}$ – 6.1 µg/m^3, from the BCD Bathurst station during 2017;
- annual dust deposition – 1.4 g/m^2/month, from the on-site directional dust gauge monitoring network;
- annual lead concentrations – due to an absence of significant lead emission sources in the surrounding region, background lead concentrations in the local airshed are considered to be negligible;
- NO_2 – hourly varying concentrations recorded at ACT Health Monash station during 2017 for contemporaneous OLM analysis with modelling period predictions; and
- O_3 – hourly varying concentrations recorded at ACT Health Monash station during 2017 for contemporaneous ozone limiting method (OLM) analysis with modelling period predictions.

Further detail on how the background air quality was characterised for modelling purposes is provided in Chapter 6 of the AQIA (Appendix M).



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Project air quality monitoring network
- Dust deposition gauge
- HVAS air sampler
- Weather station

Project air quality monitoring network

McPhillamys Gold Project
Environmental impact statement
Figure 11.4

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11.3 Assessment methodology and criteria

11.3.1 Methodology

The AQIA included an assessment of particulate matter emissions, particularly TSP, PM_{10} and $PM_{2.5}$. Dust deposition and gaseous air pollutants, as well as greenhouse gas emissions were also assessed. The results of the greenhouse gas assessment are presented in Chapter 12.

The AQIA was conducted in general accordance with the guidelines specified by the NSW EPA in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016) (Approved Methods). Consistent with Section 2.1 of the Approved Methods, the AQIA of the mine development is classed as a 'Level 2' assessment, consisting of a refined dispersion modelling approach using site-specific and/or representative inputs.

The atmospheric dispersion modelling completed for the assessment used the AERMOD dispersion model (version v18081). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

Dispersion modelling was conducted for various stages of the mine life. Four emission scenarios that are representative of different stages of the mine development were selected as follows:

- Year 1;
- Year 2;
- Year 4; and
- Year 8.

The four scenarios modelled are considered to provide an indication of impacts under a range of operational conditions during the life of the mine development. Emissions from the initial construction phase are accounted for in the Year 1 emissions scenario. Year 2 and 4 represent the highest periods of material extraction, haulage and processing for the mine development. Year 8 represents the longest haulage distances for ore material from the developed pit.

The noise assessment considered the same scenarios, which are illustrated in Figures 2.4a to 2.4d in Chapter 2.

11.3.2 Potential air pollutants

The operation of the mine development has the potential to generate emissions of various air pollutants to the atmosphere. Emission sources will include a mixture of the following:

- fugitive sources of particulate matter, such as material handling and processing activities, movement of mobile plant and equipment, and wind erosion of exposed surfaces;
- fugitive releases from the ore processing circuit and surface of active TSF; and
- combustion sources, such as exhaust emissions from site equipment fleet, emergency generator and processing plant and blasting operations.

Specific activities that could generate these emissions include:

- clearing and transportation of topsoil material;

- drill and blasting activities in pit area;
- loading of blasted waste rock and ore material to haul trucks;
- transport of waste rock to waste rock emplacement and infrastructure areas;
- waste rock emplacement management by dozers;
- transport of ore material to the ROM pad;
- material crushing, screening and grinding circuit and associated conveyor transfers;
- wind erosion associated with waste rock dumps, topsoil stockpiles, ore material stockpiles and other exposed surfaces;
- diesel fuel combustion by on-site plant and equipment;
- fuel combustion associated with processing plant furnace and kiln; and
- fugitive releases from the processing circuit and TSF.

A detailed description of emission sources associated with the project is presented in Chapter 7 of the AQIA report (refer to Appendix M). Air pollutants emitted by the mine development from these sources may comprise of:

- particulate matter, specifically:
    - total suspended particulate matter (TSP);
    - particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}); and
    - particulate matter less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$).
- oxides of nitrogen (NO_x)[5], including nitrogen dioxide (NO_2);
- sulphur dioxide (SO_2);
- carbon monoxide (CO);
- volatile organic compounds (VOCs);
- hydrogen cyanide (HCN); and
- assorted metals and metalloids[6].

5 By convention, NOx = Nitrous oxide (NO) + NO_2.

6 A metalloid is a chemical element which has properties that are intermediate between those of typical metals and non-metals (eg silicon, arsenic).

11.3.3 Air quality criteria

In NSW, proposed developments must demonstrate compliance with the impact assessment criteria specified in the Approved Methods (EPA 2016). These criteria are designed to ensure maintenance of ambient air quality levels that protect human health and well-being. Relevant ambient air quality criteria applicable to the mine development are described below.

i Particulate matter

The NSW EPA's impact assessment criteria for particulate matter, as documented in Section 7 of the Approved Methods for Modelling, are presented in 11.2. The assessment criteria for PM_{10} and $PM_{2.5}$ are consistent with the national air quality standards that are defined in the *National Environment Protection (Ambient Air Quality) Measure* (AAQ NEPM) (Department of the Environment 2016).

TSP, which relates to airborne particles less than around 50 µm in diameter, is used as a metric for assessing amenity impacts (reduction in visibility, dust deposition and soiling of buildings and surfaces) rather than health impacts (NSW EPA, 2013). Particles less than 10 µm in diameter, accounted for in AQIA for the mine development by PM_{10} and $PM_{2.5}$, are a subset of TSP and are fine enough to enter the human respiratory system. The NSW EPA impact assessment criteria for PM_{10} and $PM_{2.5}$ are therefore used to assess the potential impacts of airborne particulate matter on human health.

For dust deposition, the NSW EPA (2016) specifies criteria for emissions from the project alone, and cumulative dust deposition levels.

Table 11.2 Impact assessment criteria for particulate matter

PM metric	Averaging period	Impact assessment criterion
TSP	Annual	90 µg/m^3
PM_{10}	24 hour	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hour	25 µg/m^3
	Annual	8 µg/m^3
Dust deposition	Annual	2 g/m^2/month (Project increment only)
		4 g/m^2/month (cumulative)

Notes: µg/m^3: micrograms per cubic meter; g/m^2/month: grams per square metre per month

ii Gaseous pollutants

As stated, the mine development is anticipated to generate emissions of a range of gaseous pollutants, including NO_x/NO_2, CO, SO_2 and VOCs from fuel combustion and blasting, and HCN from fugitive releases from the processing circuit and TSF facility. Of these gaseous pollutants, the AQIA focussed on NO_2 as the indicator of compliance from fuel combustion, and HCN emissions from the processing circuit and TSF. Blasting-related NO_x emissions have also been assessed.

The impact assessment criteria for NO_2 and HCN, as defined by the NSW EPA (2016), are summarised in Table 11.3.

Table 11.3 Impact assessment criteria for NO_2 and HCN

Pollutant	Averaging period	Impact assessment criterion
NO_2	1 hour	246 µg/m^3
	Annual	62 µg/m^3
HCN	99.9th percentile 1-hour average	200 µg/m^3

The impact assessment criteria for NO_2 are applicable at the nearest existing or likely future off-site sensitive receptor. In assessing compliance against the applicable criteria, the maximum cumulative concentration (project related emissions plus background concentration) at each receptor must be reported as the 100th percentile concentration (ie maximum concentration) for the relevant averaging period.

The criterion for HCN is applicable at and beyond the boundary of the mine development. The criterion is applicable to the project-only (incremental) concentration and is reported as the 99.9th percentile 1-hour average (EPA 2016).

iii Metals and metalloids

Emissions of assorted individual metals and metalloids contained within the waste, ore and tailings material may occur during the life of the mine. Geochemistry profiles have been undertaken for the waste rock, ore and tailings to be produced by the mine development. Of the detected elements, those with an EPA impact assessment criterion are presented in Table 11.4.

It is noted that for each of the pollutants listed in Table 11.4, with the exception of lead, the impact assessment criterion specified by the NSW EPA must be applied at and beyond the boundary of the mine development, with the incremental impact (ie predicted impacts due to the pollutant source alone) for each pollutant reported as the 99.9th percentile 1-hour average concentration. The criterion for lead is an annual average and is applied at the selected sensitive receptors.

Table 11.4 Impact assessment criteria – metals and metalloids

Element	Impact assessment criterion (µg/m^3)	Averaging period
Antimony and compounds (Sb)	9.0	99.9th percentile 1-hour
Arsenic and compounds (As)	0.09	99.9th percentile 1-hour
Barium (soluble compound) (Ba)	9.0	99.9th percentile 1-hour
Beryllium and compounds (Be)	0.004	99.9th percentile 1-hour
Cadmium and compounds (Cd)	0.018	99.9th percentile 1-hour
Chromium VI and compounds (Cr)	0.09	99.9th percentile 1-hour
Copper dusts and mists (Cu)	18	99.9th percentile 1-hour
Lead (Pb)	0.5	Annual average
Manganese and compounds (Mn)	18	99.9th percentile 1-hour
Mercury organic (Hg)	0.18	99.9th percentile 1-hour
Nickel and compounds (Ni)	0.18	99.9th percentile 1-hour
Silver (soluble compounds) (Ag)	0.18	99.9th percentile 1-hour

iv Voluntary land acquisition and mitigation policy

As described in Chapter 10 with reference to noise, DPIE released the revised VLAMP in 2018 (DPE 2018a). This policy also outlines mitigation and acquisition criteria for particulate matter.

In relation to dust, voluntary mitigation rights apply when a development contributes to exceedances of the criteria set out in Table 11.5. Voluntary acquisition rights apply when a development contributes to exceedances of the criteria set out in Table 11.6. The criteria for voluntary mitigation and acquisition are the same, except for the number of days the short-term impact assessment criteria for PM_{10} and $PM_{2.5}$ can be exceeded, which is zero for mitigation and five for acquisition.

Voluntary acquisition rights also apply to any residence or any workplace on privately-owned land, but also apply when an exceedance occurs across more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

Table 11.5 VLAMP mitigation criteria for air quality

Pollutant	Averaging period	Mitigation criterion	Impact type
PM_{10}	24-hour	50 µg/m³**	Human health
	Annual	25 µg/m³*	Human health
$PM_{2.5}$	24-hour	25 µg/m³**	Human health
	Annual	8 µg/m³*	Human health
TSP	Annual	90 µg/m³*	Amenity
Deposited dust	Annual	2 g/m²/month**	Amenity
		4 g/m²/month*	

Note: * - cumulative impact (project + background); ** - incremental impact (project only) with zero allowable exceedances of the criteria over the life of the development

Table 11.6 VLAMP acquisition criteria for air quality

Pollutant	Averaging period	Mitigation criterion	Impact type
PM_{10}	24-hour	50 µg/m³**	Human health
	Annual	25 µg/m³*	Human health
$PM_{2.5}$	24-hour	25 µg/m³**	Human health
	Annual	8 µg/m³*	Human health
TSP	Annual	90 µg/m³*	Amenity
Deposited dust	Annual	2 g/m²/month**	Amenity
		4 g/m²/month*	

Note: * - cumulative impact (project + background); ** - incremental impact (project only) with five allowable exceedances of the criteria over the life of the development

11.4 Impact assessment

11.4.1 Incremental (mine development only) results

The most significant source of emissions from the mine development will be associated with the movement of vehicles across unpaved road surfaces. Waste rock emplacement operations and wind erosion of exposed surfaces are also notable contributing sources of particulate matter on an annual basis.

A range of mitigation measures have been identified and committed to, so that emissions to the atmosphere as a result of the mine development are minimised. These mitigation measures are presented in Section 11.5 and have been included in the dispersion modelling of the mine development.

The predicted incremental concentrations (that is from the mine only, not including background emissions) and deposition rates from the four modelled scenarios were collated, and the maximum predicted results across the 88 receptors are presented in Table 11.7. In the case of the assorted metals and metalloids and HCN, the maximum predicted mine related concentrations presented are the maximum predicted concentration at the project area boundary.

The predicted concentrations and deposition rates for all pollutants and averaging periods presented in Table 11.7 are below the applicable NSW EPA assessment criteria. However, with the exception of dust deposition and the assorted metals and metalloids and HCN, the assessment criteria listed are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in Section 11.4.2 and Table 11.8.

Contour plots, illustrating spatial variations in site-related incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates, are provided in Figures 11.5 to 11.22 below.

Table 11.7 Summary of highest predicted project-only increment concentrations and deposition levels across all assessment locations

Pollutant	Averaging period	Unit	Year 1	Year 2	Year 4	Year 8	Criterion
TSP	Annual	µg/m³	3.2	5.1	4.8	1.4	90
PM_{10}	24-hour maximum	µg/m³	25.6	29.3	29.6	7.7	50
	Annual	µg/m³	2.1	3.1	2.7	0.8	25
$PM_{2.5}$	24-hour maximum	µg/m³	5.2	7.0	5.7	1.8	25
	Annual	µg/m³	0.5	0.6	0.5	0.2	8
Dust deposition	Annual	g/m²/ month	0.5	0.8	0.8	0.3	2
NO_2	1-hour maximum	µg/m³	150.4				246
	Annual	µg/m³	5.7				62
HCN	99.9th percentile 1-hour	µg/m³	69.6				200
Ag	99.9th percentile 1-hour	µg/m³	3.79E-05	4.96E-05	7.16E-05	3.35E-05	1.8
As	99.9th percentile 1-hour	µg/m³	5.89E-03	7.71E-03	1.11E-02	5.20E-03	0.09
Ba	99.9th percentile 1-hour	µg/m³	1.00E-02	1.31E-02	1.89E-02	8.84E-03	9
Be	99.9th percentile 1-hour	µg/m³	1.56E-05	2.04E-05	2.94E-05	1.38E-05	0.004
Cd	99.9th percentile 1-hour	µg/m³	1.56E-05	2.04E-05	2.95E-05	1.38E-05	0.018
Cr	99.9th percentile 1-hour	µg/m³	2.86E-04	3.74E-04	5.40E-04	2.53E-04	0.09
Cu	99.9th percentile 1-hour	µg/m³	3.04E-02	3.98E-02	5.74E-02	2.68E-02	18
Fe	99.9th percentile 1-hour	µg/m³	8.5	11.1	16.1	7.5	90
Hg	99.9th percentile 1-hour	µg/m³	2.93E-06	3.83E-06	5.53E-06	2.59E-06	0.18
Mg	99.9th percentile 1-hour	µg/m³	2.1	2.8	4.0	1.9	180
Mn	99.9th percentile 1-hour	µg/m³	0.2	0.2	0.4	0.2	18
Ni	99.9th percentile 1-hour	µg/m³	9.12E-04	1.19E-03	1.72E-03	8.05E-04	0.18
Pb	Annual	µg/m³	4.17E-05	6.66E-05	6.25E-05	1.90E-05	0.5
Sb	99.9th percentile 1-hour	µg/m³	1.79E-04	2.35E-04	3.39E-04	1.58E-04	9
Zn	99.9th percentile 1-hour	µg/m³	1.37E-02	1.79E-02	2.59E-02	1.21E-02	90

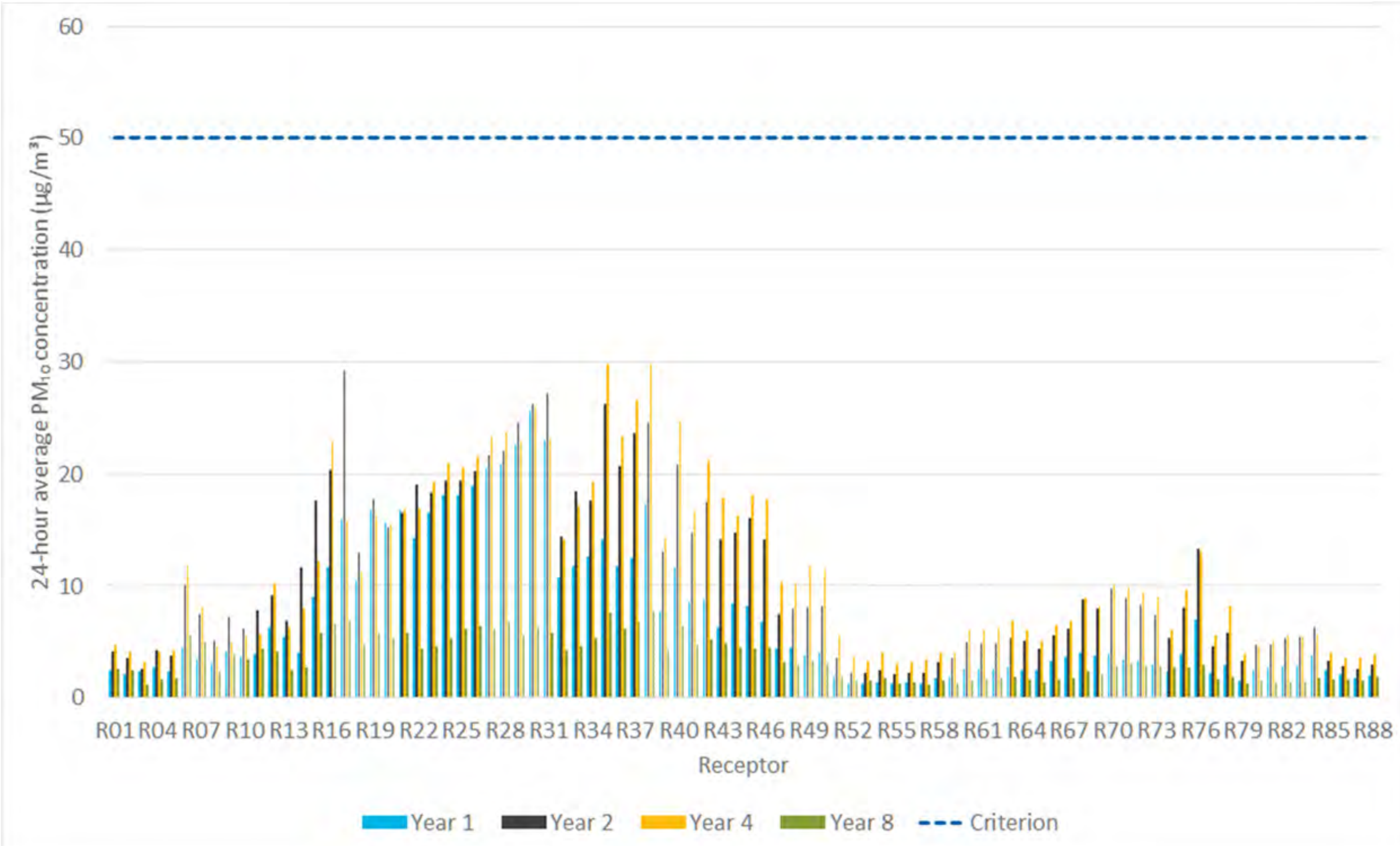


Figure 11.5 **Maximum incremental 24-hour average PM_{10} concentrations – all scenarios**

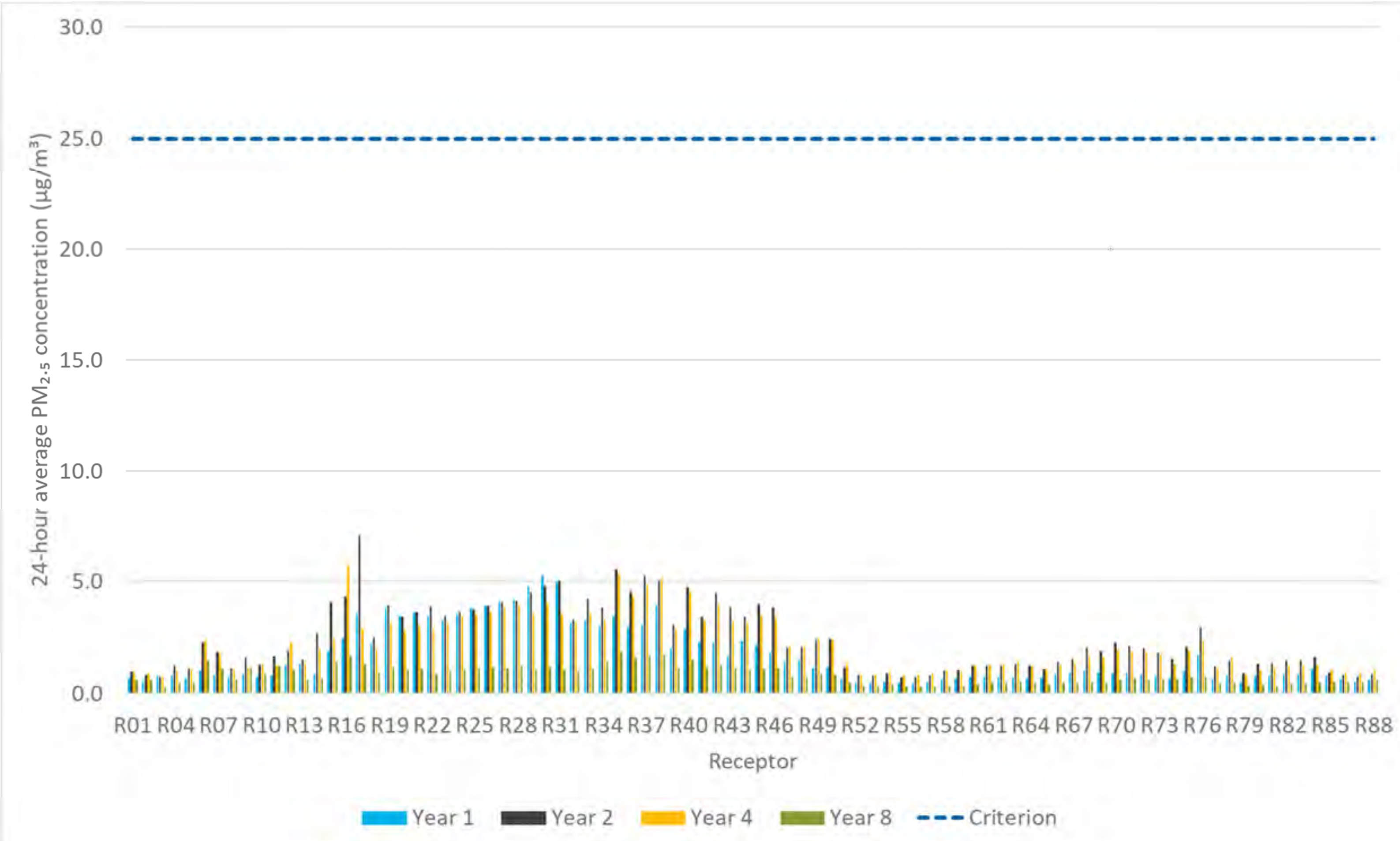
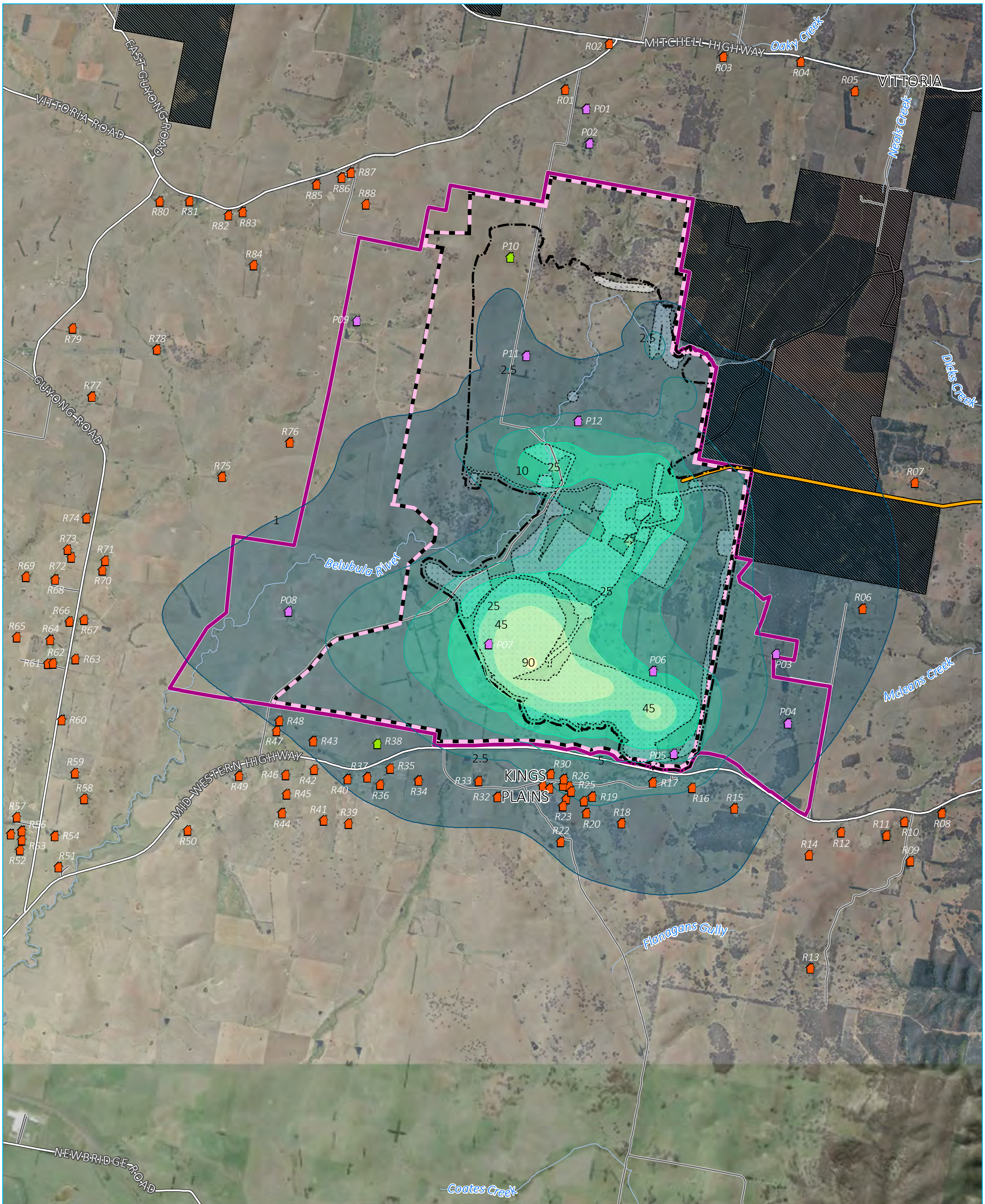


Figure 11.6 Maximum incremental 24-hour average $PM_{2.5}$ concentrations – all scenarios



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

GDA 1994 MGA Zone 55

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 1

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Annual average TSP concentrations

- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³
- 45 µg/m³
- 90 µg/m³

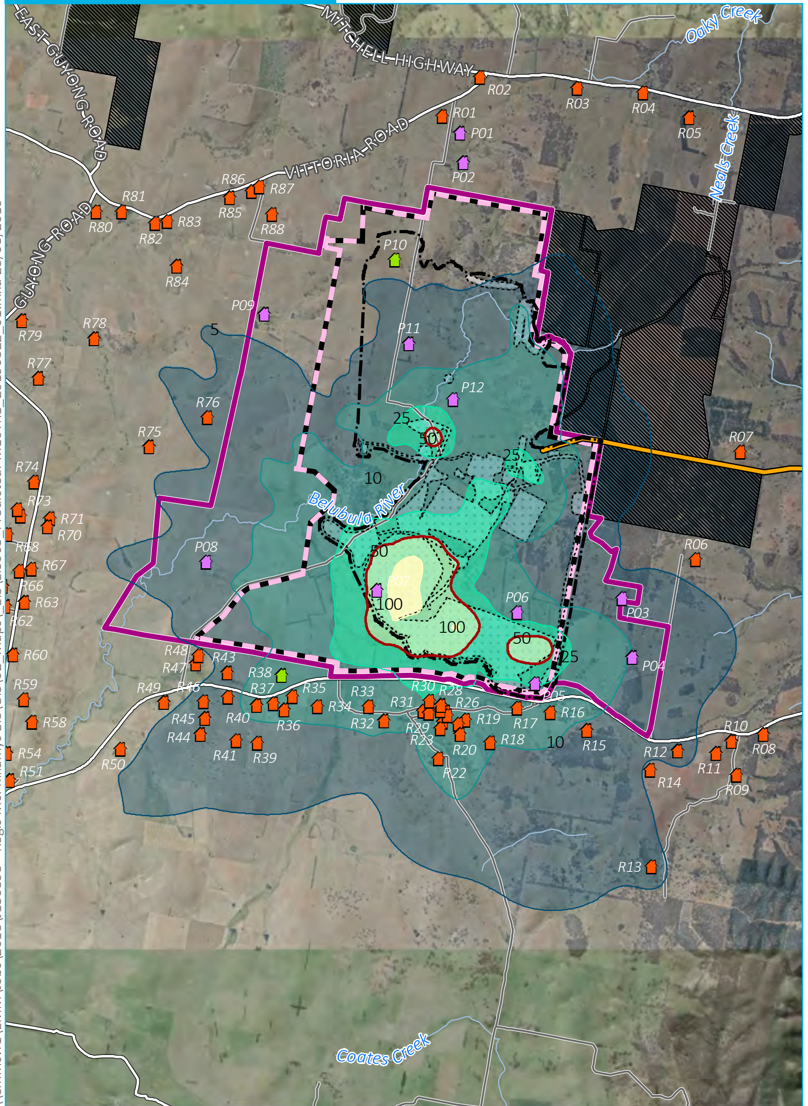
Annual average TSP concentration range

- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- 25 - 45 µg/m³
- 45 - 90 µg/m³
- > 90 µg/m³

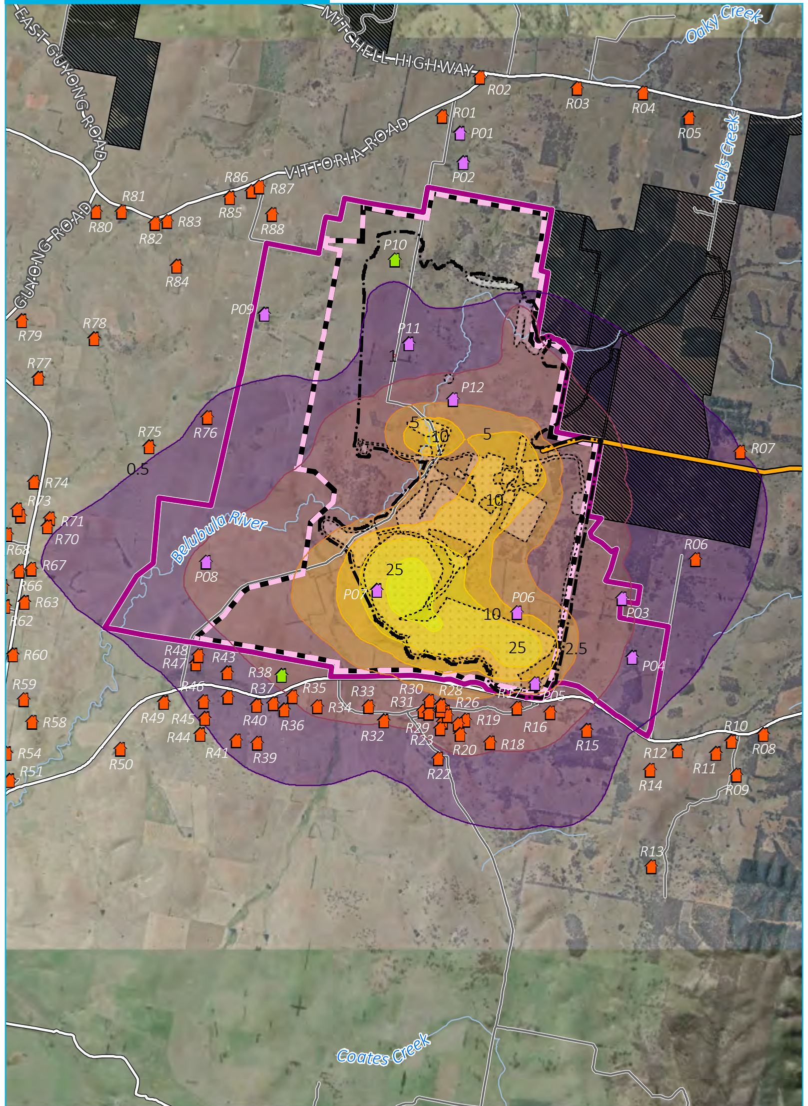
Predicted annual average TSP concentrations (µg/m³) – Year 1 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.7

24-HOUR AVERAGE PM_{10} CONCENTRATION



ANNUAL AVERAGE PM_{10} CONCENTRATION



KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 1

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

24-hour average PM_{10} concentrations
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³
- 50 µg/m³ (incremental VLAMP mitigation criteria)
- 100 µg/m³

24-hour average PM_{10} concentration range
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- 25 - 50 µg/m³
- 50 - 100 µg/m³
- > 100 µg/m³

Annual average PM_{10} concentrations
- 0.5 µg/m³
- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³

Annual average PM_{10} concentration range
- 0.5 - 1 µg/m³
- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- > 25 µg/m³

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Predicted PM_{10} concentrations (µg/m³) - Year 1 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.8

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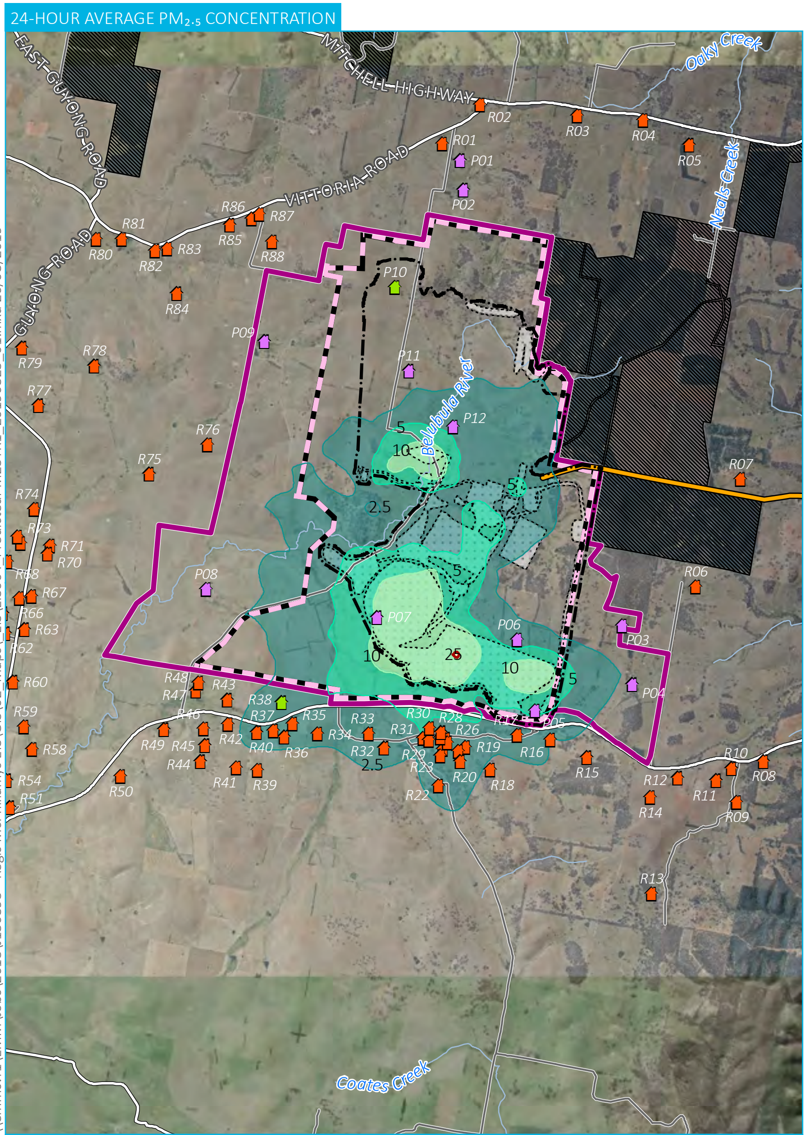

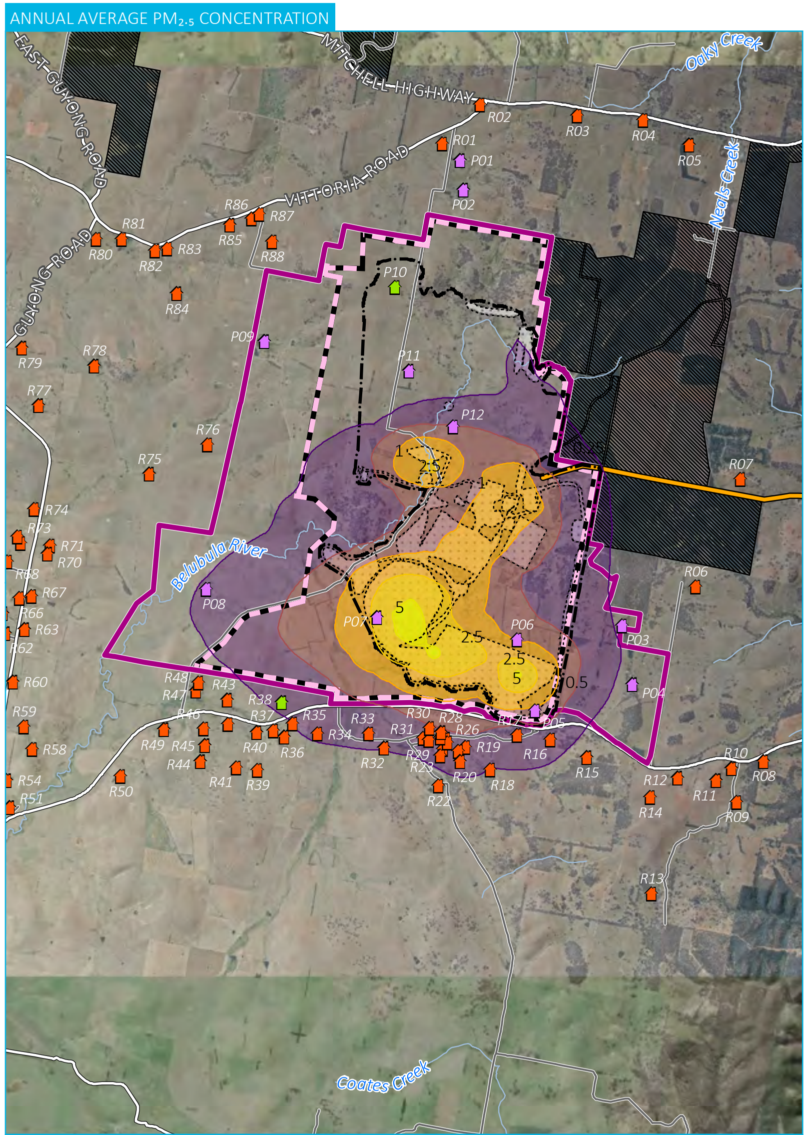

24-hour average $PM_{2.5}$ concentrations
- 2.5 μg/m³
- 5 μg/m³
- 10 μg/m³
- 25 μg/m³ (incremental VLAMP criteria)

24-hour average $PM_{2.5}$ concentration range
- 2.5 - 5 μg/m³
- 5 - 10 μg/m³
- 10 - 25 μg/m³
- > 25 μg/m³

Annual average $PM_{2.5}$ concentrations
- 0.25 μg/m³
- 0.5 μg/m³
- 1 μg/m³
- 2.5 μg/m³
- 5 μg/m³

Annual average $PM_{2.5}$ concentration range
- 0.25 - 0.5 μg/m³
- 0.5 - 1 μg/m³
- 1 - 2.5 μg/m³
- 2.5 - 5 μg/m³
- > 5 μg/m³

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 1

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Predicted $PM_{2.5}$ concentrations (μg/m³) - Year 1 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.9

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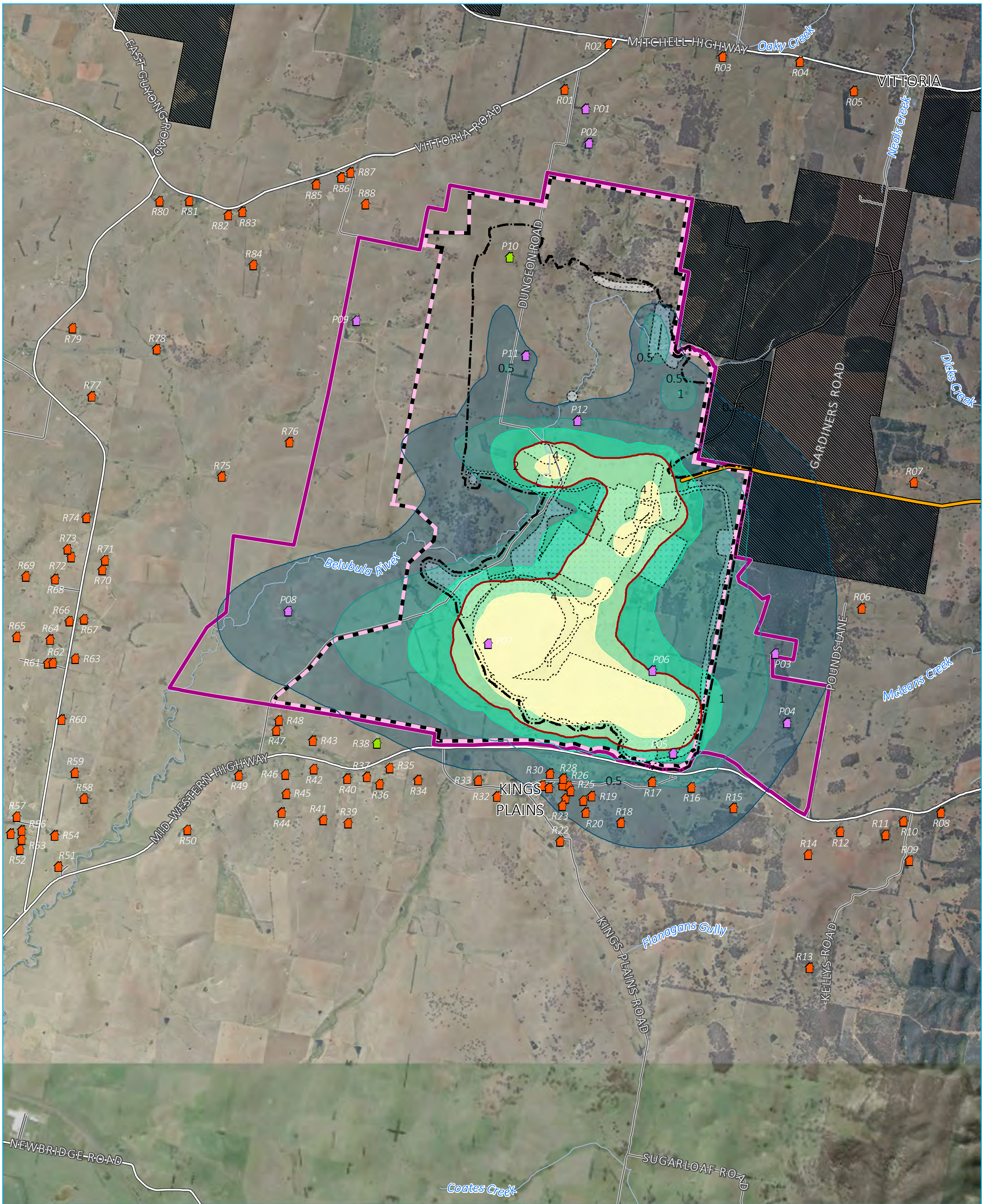


Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

\\emmsvr1\EMM\Jobs\2018\J180395 - Regis McPhillamys EIS\GIS\02_Maps_AQGHG\AQ014_AnnualDustLevelsDDP_20190823_04.mxd 23/08/2019

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- pipeline corridor
- Mine development general arrangement - Year 1

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

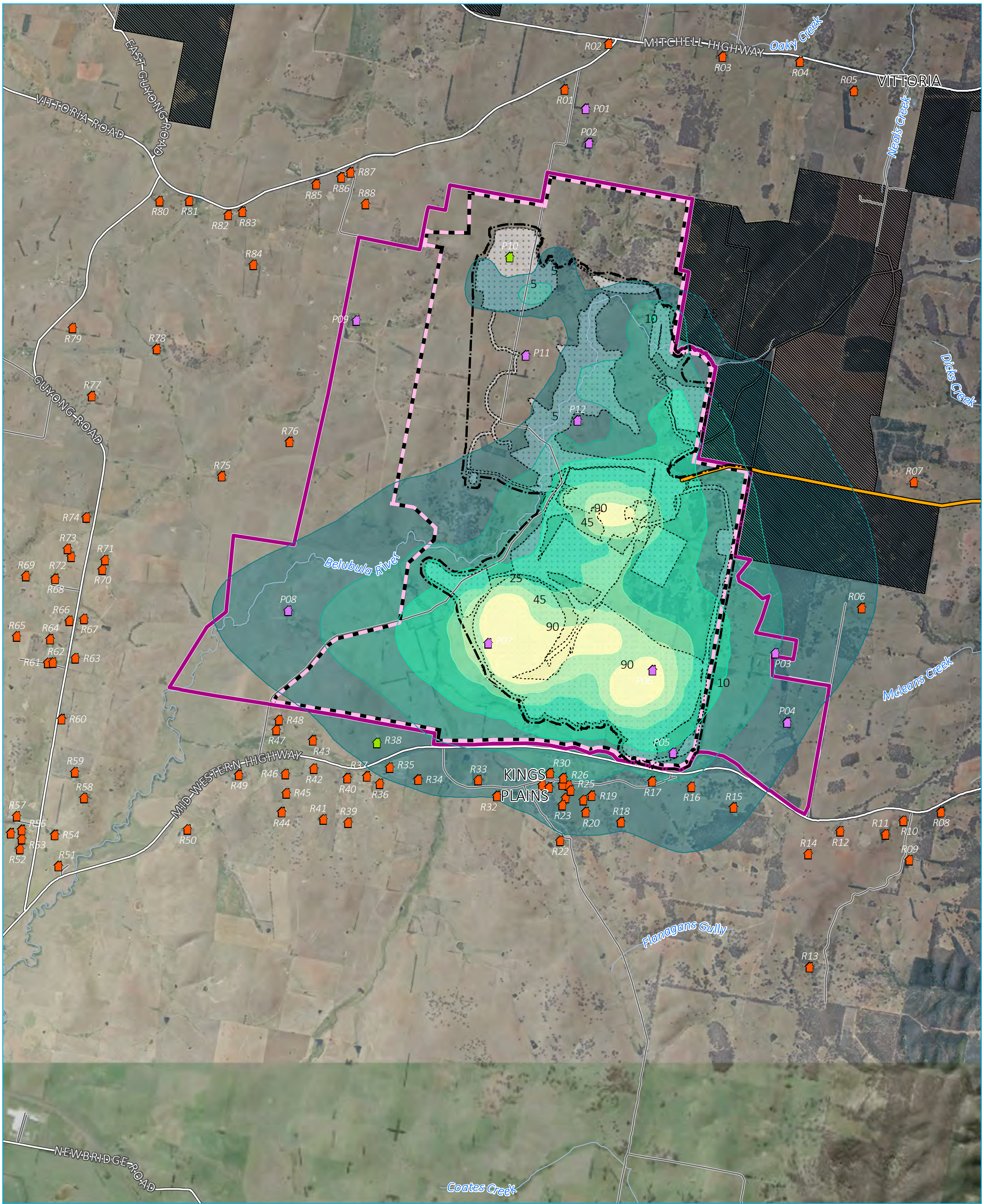
Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Average dust deposition levels
- 0.25 g/m²/month
- 0.5 g/m²/month
- 1 g/m²/month
- 2 g/m²/month (incremental VLAMP mitigation criteria)
- 4 g/m²/month

Average dust deposition level range
- 0.25 - 0.5 g/m²/month
- 0.5 - 1 g/m²/month
- 1 - 2 g/m²/month
- 2 - 4 g/m²/month
- > 4 g/m²/month

Predicted annual average dust deposition levels (g/m²/month) – Year 1 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.10



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 2

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Annual average TSP concentrations
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³
- 45 µg/m³
- 90 µg/m³

Annual average TSP concentration range
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- 25 - 45 µg/m³
- 45 - 90 µg/m³
- > 90 µg/m³

Predicted annual average TSP concentrations (µg/m³) – Year 2 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.11

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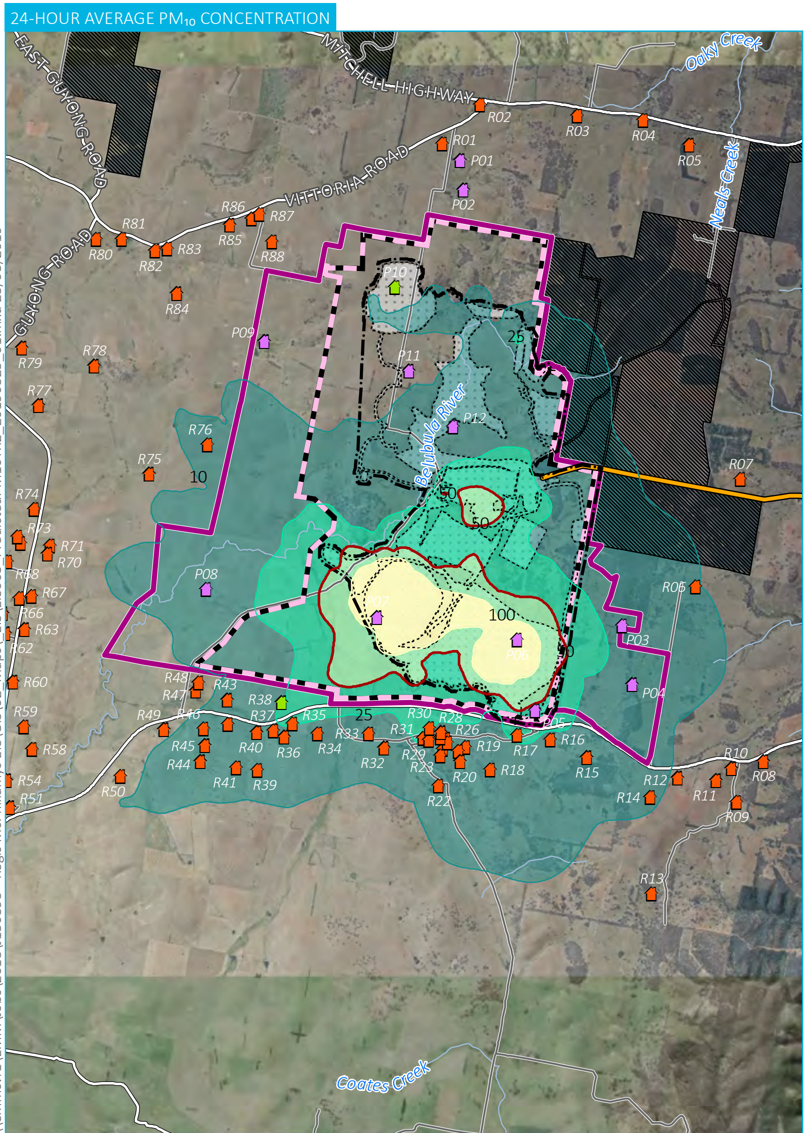
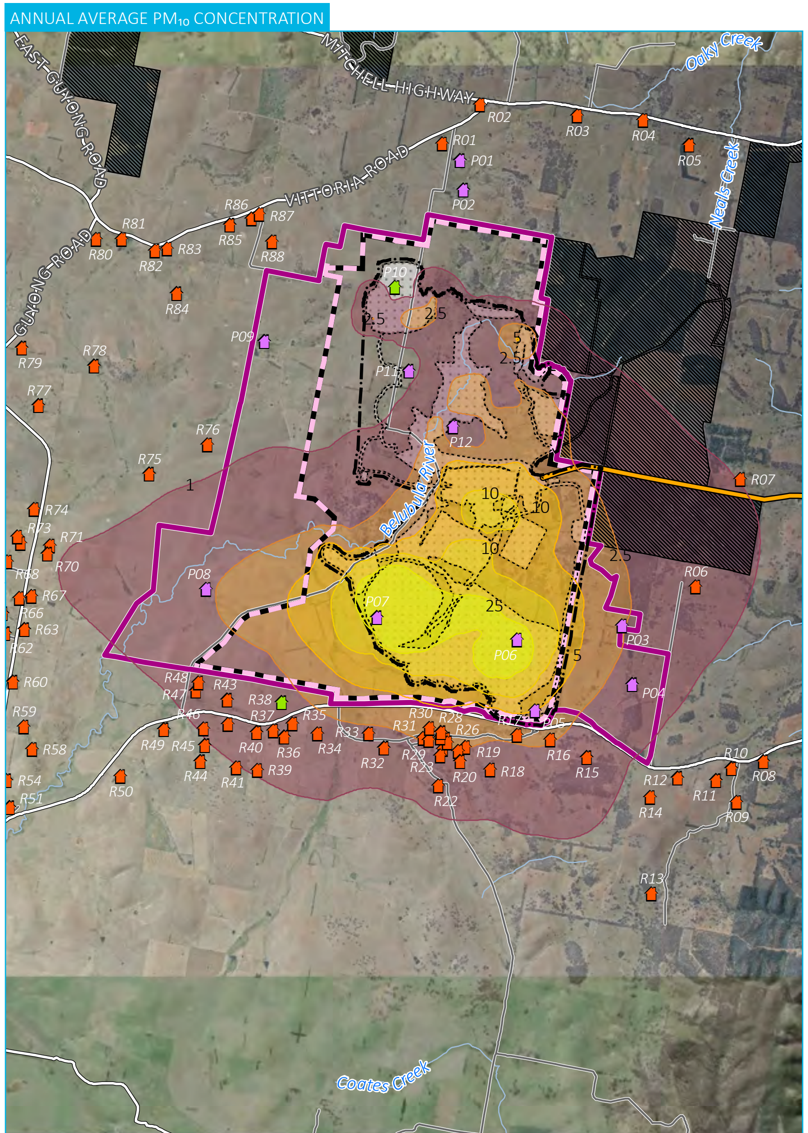


24-hour average PM_{10} concentrations
- 10 µg/m³
- 25 µg/m³
- 50 µg/m³ (incremental VLAMP mitigation criteria)
- 100 µg/m³

24-hour average PM_{10} concentration range
- 10 - 25 µg/m³
- 25 - 50 µg/m³
- 50 - 100 µg/m³
- > 100 µg/m³



Annual average PM_{10} concentrations
- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³

Annual average PM_{10} concentration range
- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- > 25 µg/m³

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 2

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Predicted PM_{10} concentrations (µg/m³) - Year 2 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.12

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55
N

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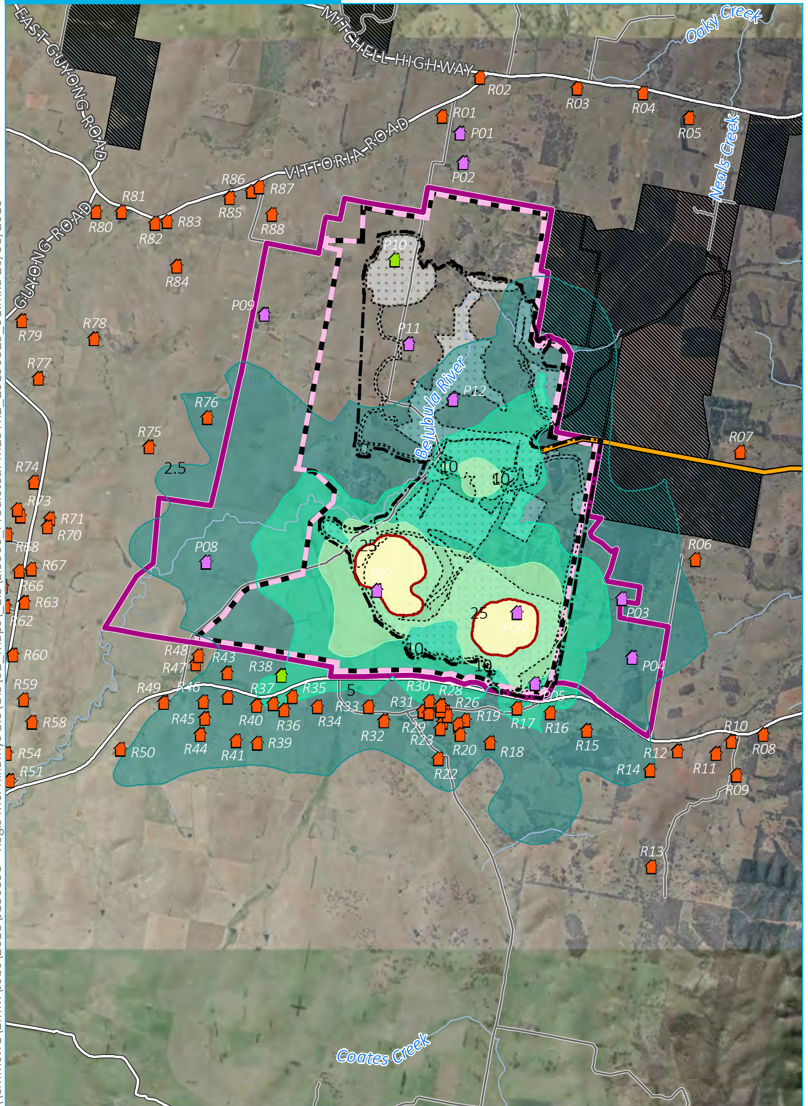
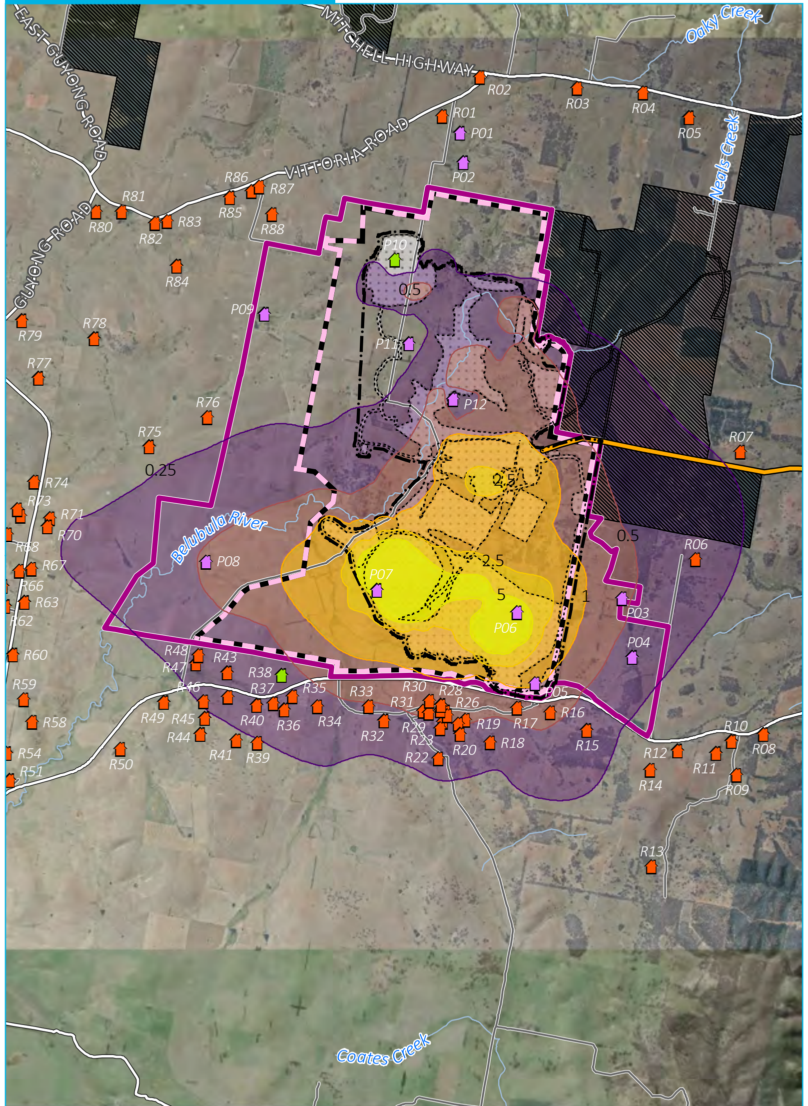
24-HOUR AVERAGE $PM_{2.5}$ CONCENTRATION



24-hour average $PM_{2.5}$ concentrations
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³ (incremental VLAMP criteria)

24-hour average $PM_{2.5}$ concentration range
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- > 25 µg/m³

ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATION



Annual average $PM_{2.5}$ concentrations
- 0.25 µg/m³
- 0.5 µg/m³
- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³

Annual average $PM_{2.5}$ concentration range
- 0.25 - 0.5 µg/m³
- 0.5 - 1 µg/m³
- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- > 5 µg/m³

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 2

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Predicted $PM_{2.5}$ concentrations (µg/m³) - Year 2 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.13

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55
N

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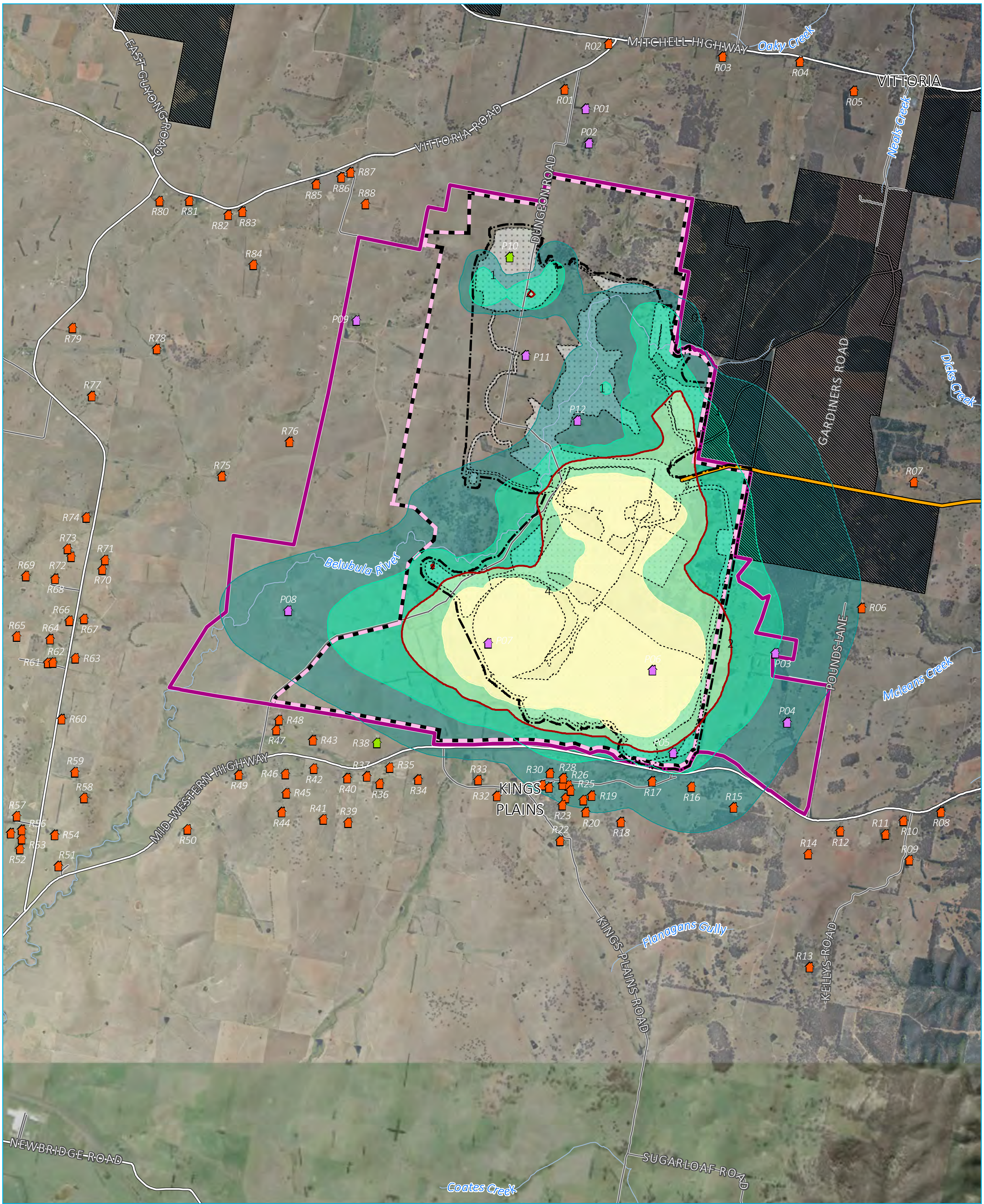

Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

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KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- pipeline corridor
- Mine development general arrangement - Year 2

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Average dust deposition levels
- 0.5 g/m²/month
- 1 g/m²/month
- 2 g/m²/month (incremental VLAMP mitigation criteria)
- 4 g/m²/month

Average dust deposition level range
- 0.5 - 1 g/m²/month
- 1 - 2 g/m²/month
- 2 - 4 g/m²/month
- > 4 g/m²/month

Predicted annual average dust deposition levels (g/m²/month) – Year 2 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.14

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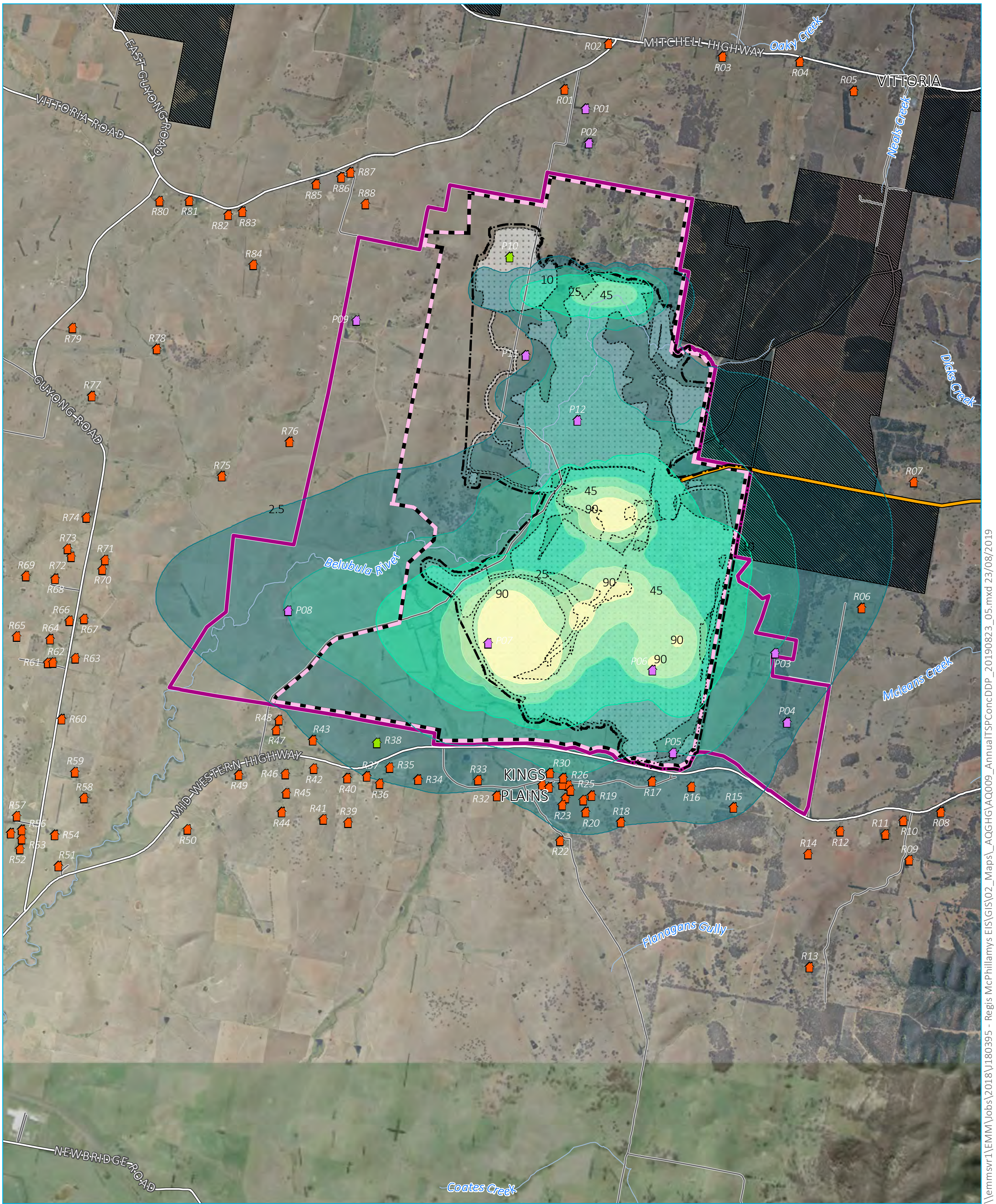


Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 4

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

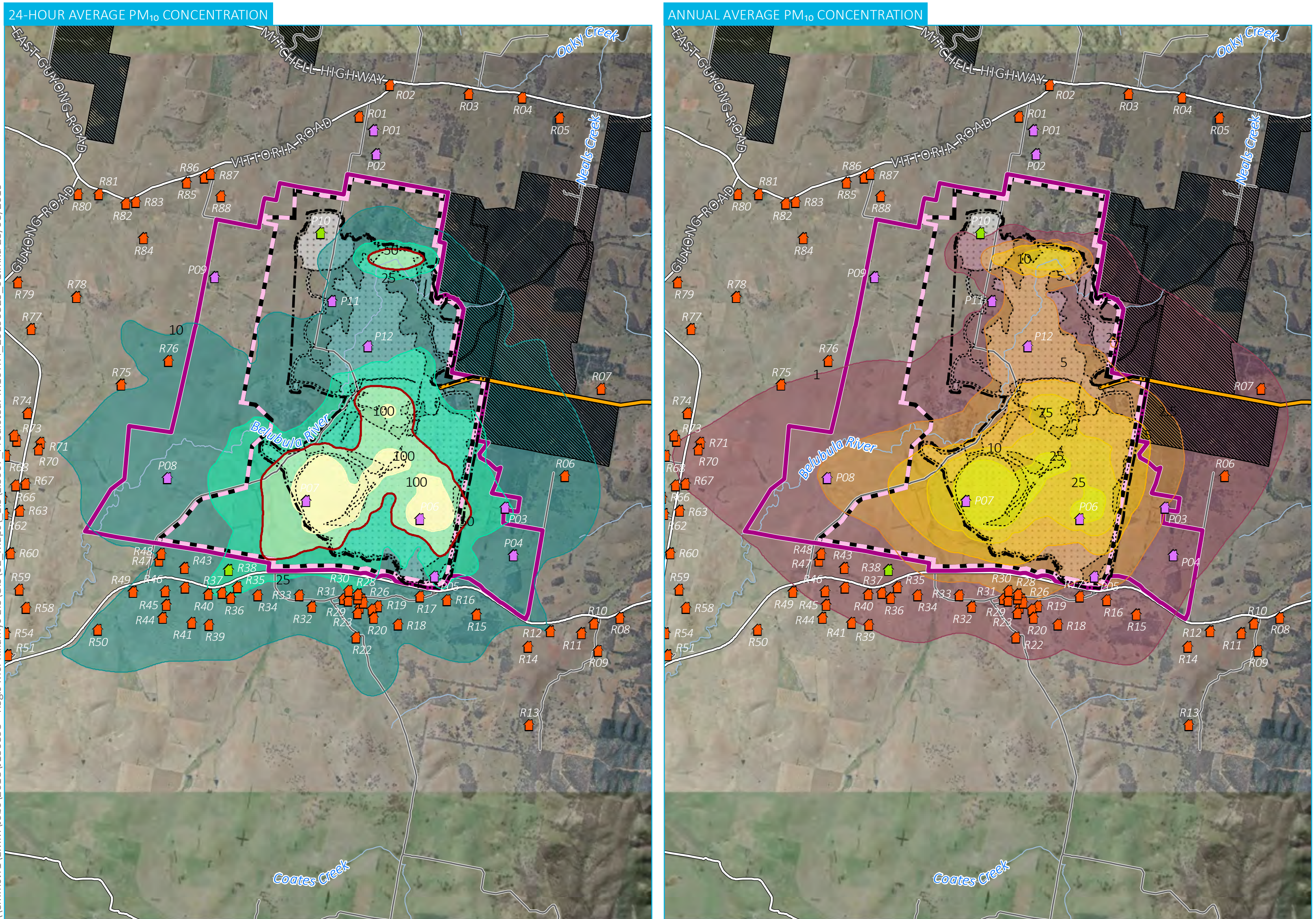
Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Annual average TSP concentrations
- 2.5 μg/m³
- 5 μg/m³
- 10 μg/m³
- 25 μg/m³
- 45 μg/m³
- 90 μg/m³

Annual average TSP concentration range
- 2.5 - 5 μg/m³
- 5 - 10 μg/m³
- 10 - 25 μg/m³
- 25 - 45 μg/m³
- 45 - 90 μg/m³
- > 90 μg/m³

Predicted annual average TSP concentrations (μg/m³) – Year 4 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.15



24-hour average PM_{10} concentrations

- 10 µg/m³
- 25 µg/m³
- 50 µg/m³ (incremental VLAMP mitigation criteria)
- 100 µg/m³

24-hour average PM_{10} concentration range

- 10 - 25 µg/m³
- 25 - 50 µg/m³
- 50 - 100 µg/m³
- > 100 µg/m³

Annual average PM_{10} concentrations

- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³

Annual average PM_{10} concentration range

- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- > 25 µg/m³

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 4

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

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Predicted PM_{10} concentrations (µg/m³) - Year 4 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.16

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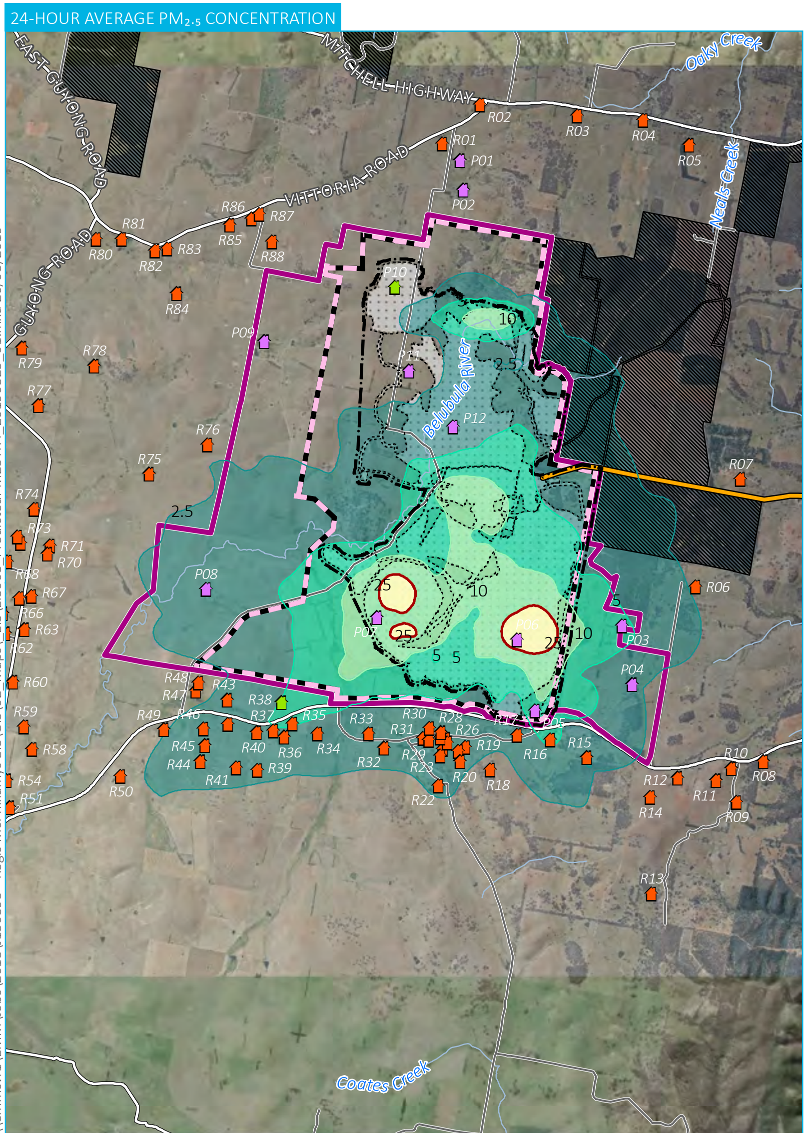
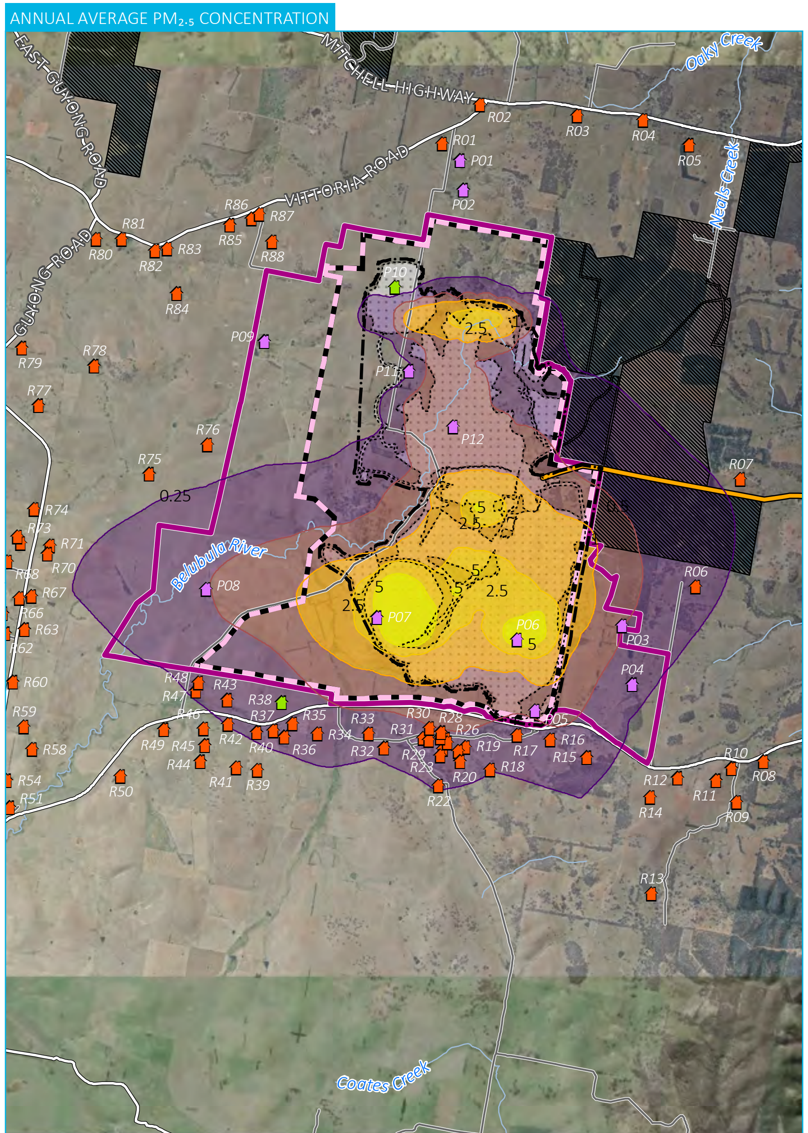




KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 4

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

24-hour average $PM_{2.5}$ concentrations
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³ (incremental VLAMP criteria)

24-hour average $PM_{2.5}$ concentration range
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- > 25 µg/m³

Annual average $PM_{2.5}$ concentrations
- 0.25 µg/m³
- 0.5 µg/m³
- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³

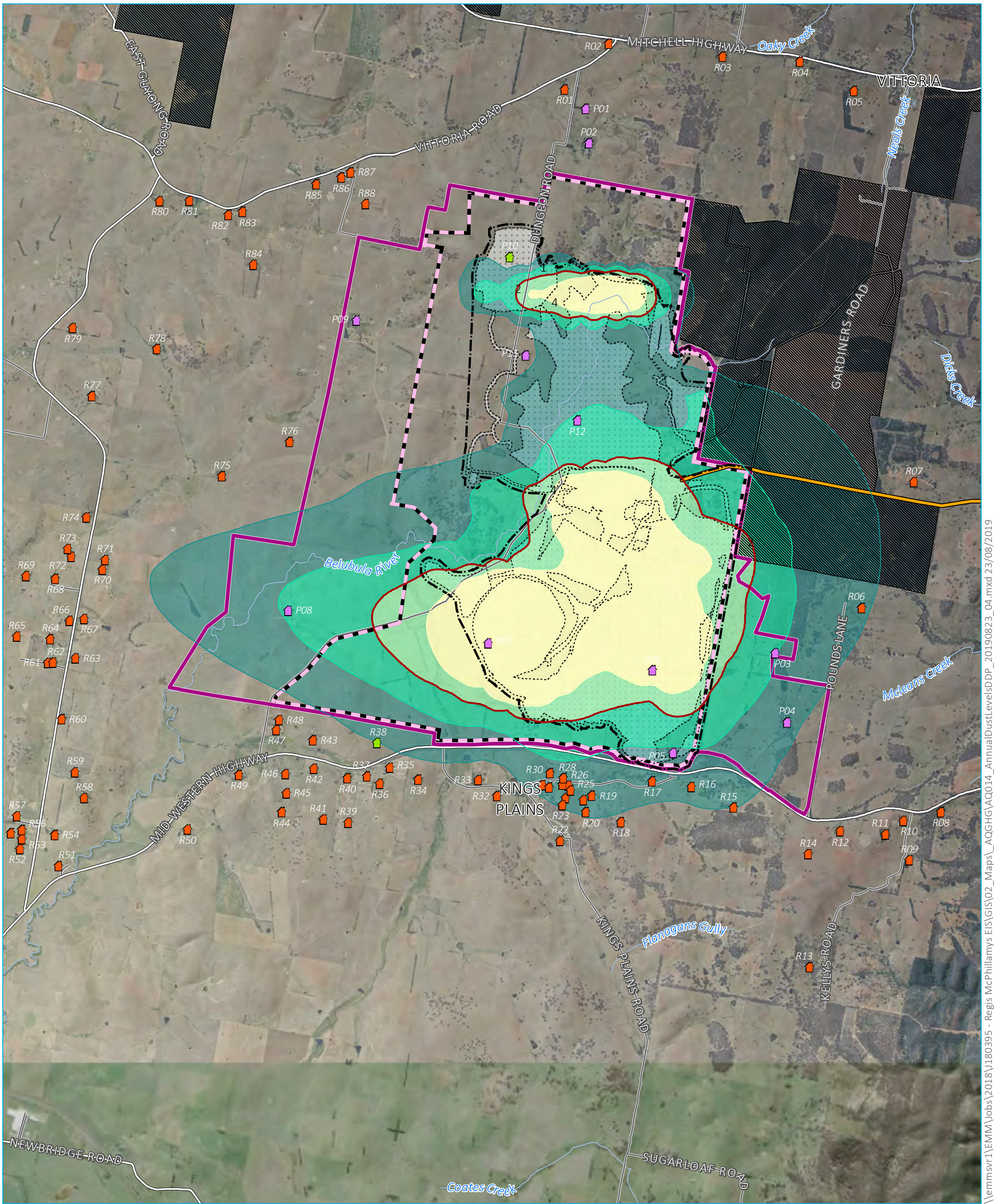
Annual average $PM_{2.5}$ concentration range
- 0.25 - 0.5 µg/m³
- 0.5 - 1 µg/m³
- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- > 5 µg/m³

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55

Predicted $PM_{2.5}$ concentrations (µg/m³) - Year 4 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.17



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- pipeline corridor
- Mine development general arrangement - Year 4

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

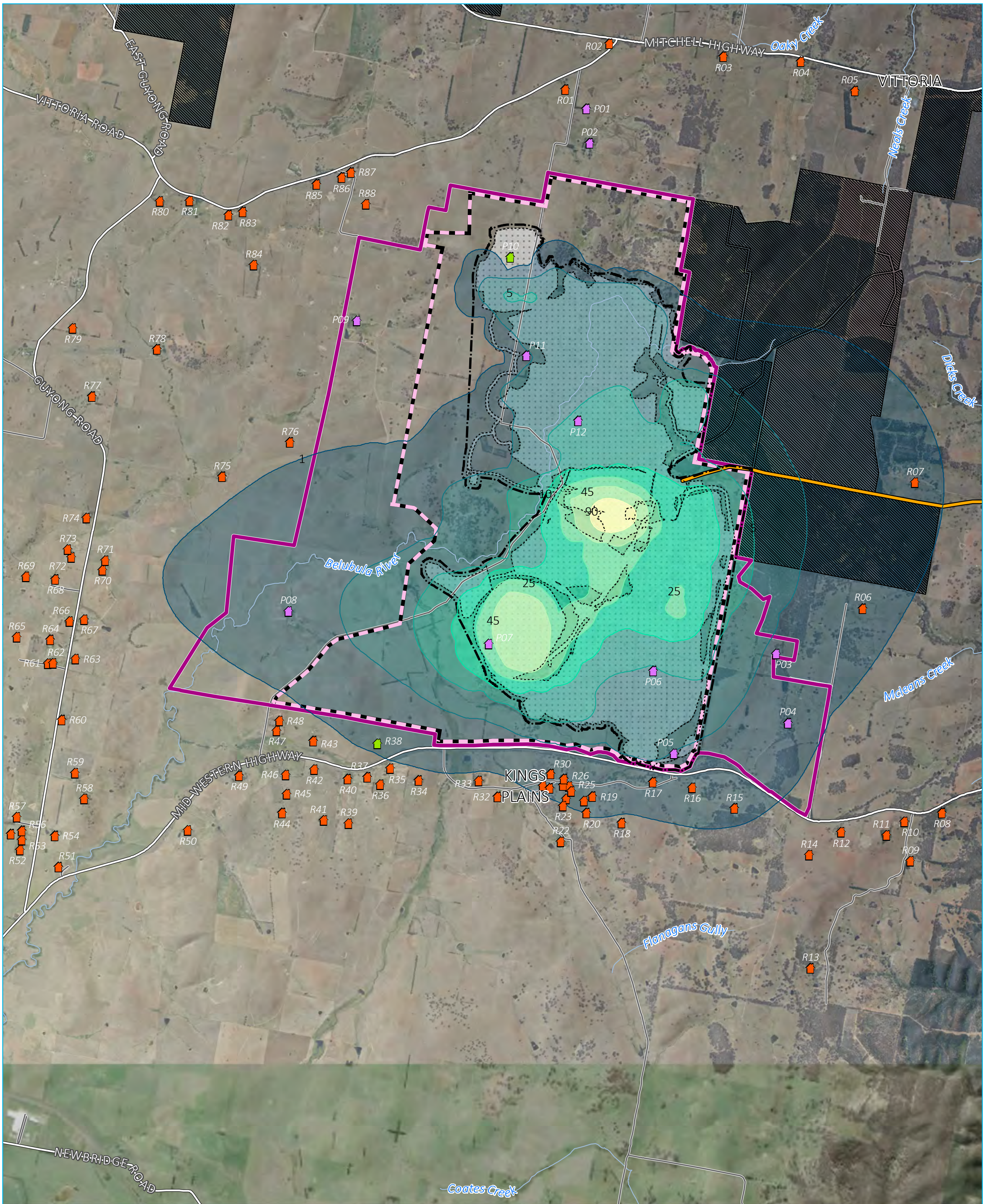
Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Average dust deposition levels
- 0.5 g/m²/month
- 1 g/m²/month
- 2 g/m²/month (incremental VLAMP mitigation criteria)
- 4 g/m²/month

Average dust deposition level range
- 0.5 - 1 g/m²/month
- 1 - 2 g/m²/month
- 2 - 4 g/m²/month
- > 4 g/m²/month

Predicted annual average dust deposition levels (g/m²/month) – Year 4 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.18



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

N

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KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 8

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Annual average TSP concentrations

- 1 μg/m³
- 2.5 μg/m³
- 5 μg/m³
- 10 μg/m³
- 25 μg/m³
- 45 μg/m³
- 90 μg/m³

Annual average TSP concentration range

- 1 - 2.5 μg/m³
- 2.5 - 5 μg/m³
- 5 - 10 μg/m³
- 10 - 25 μg/m³
- 25 - 45 μg/m³
- 45 - 90 μg/m³
- > 90 μg/m³

Predicted annual average TSP concentrations (μg/m³) – Year 8 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.19

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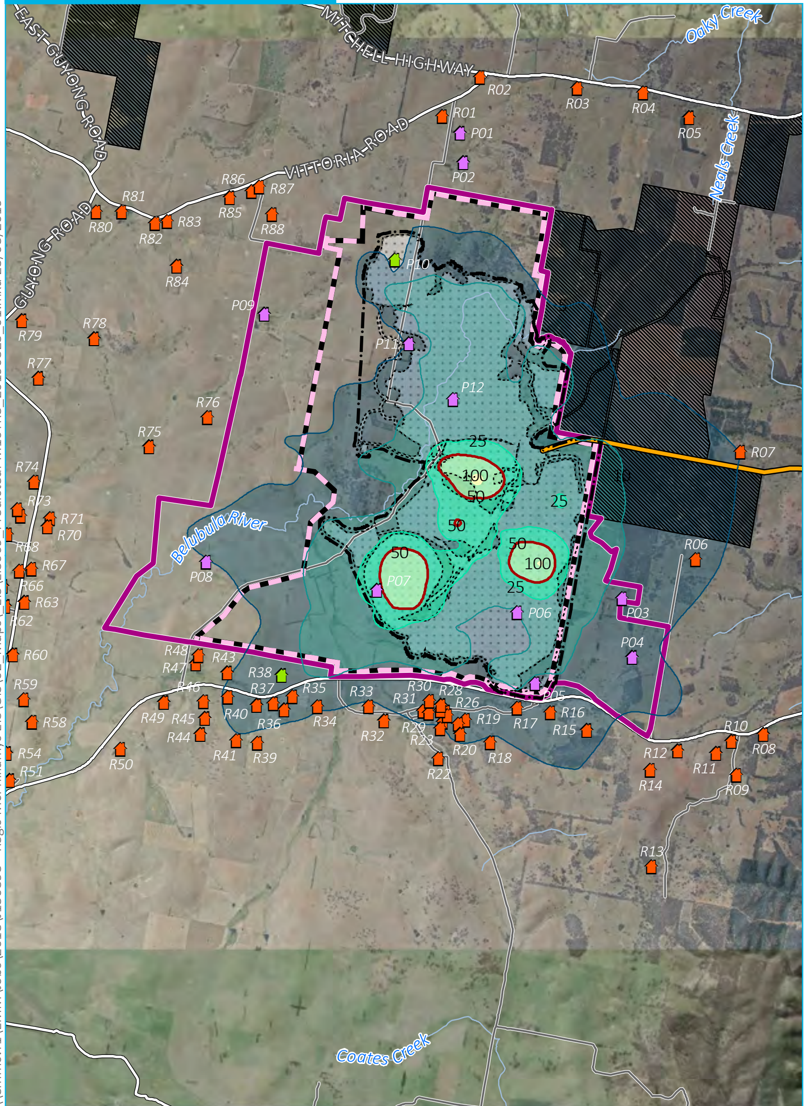
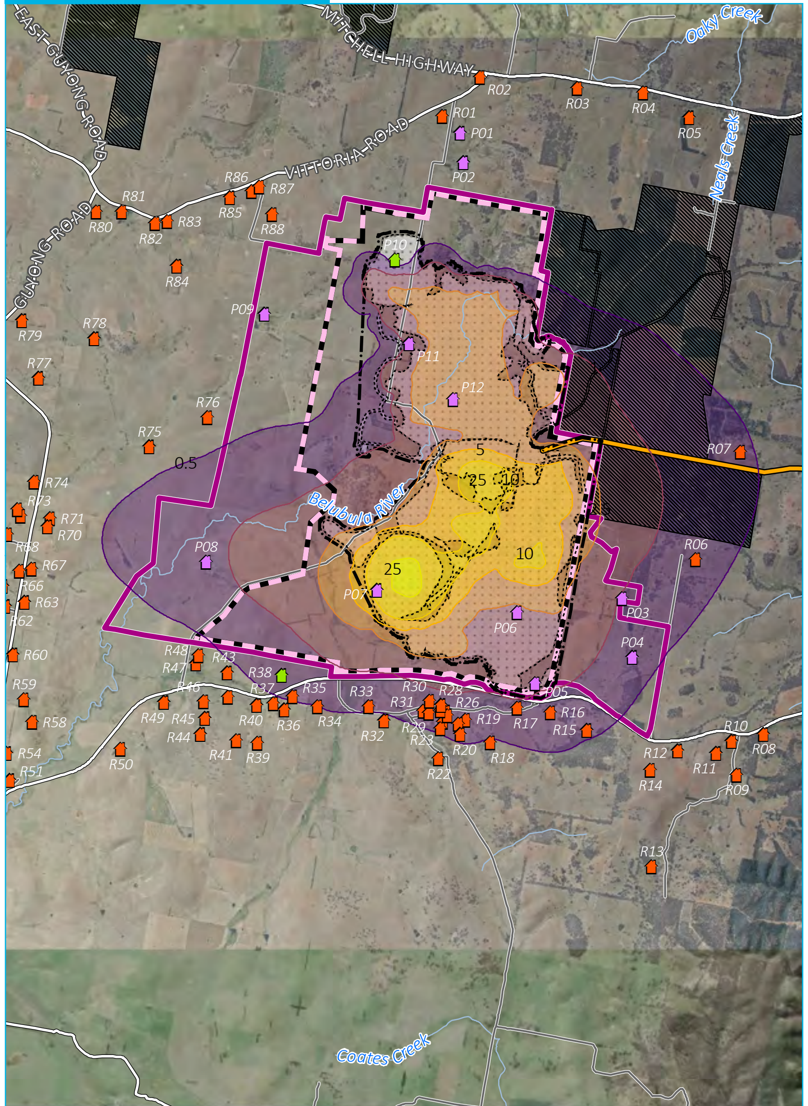
EMM creating opportunities

24-HOUR AVERAGE PM_{10} CONCENTRATION



ANNUAL AVERAGE PM_{10} CONCENTRATION



KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 8

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

24-hour average PM_{10} concentrations
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³
- 50 µg/m³ (incremental VLAMP mitigation criteria)
- 100 µg/m³

24-hour average PM_{10} concentration range
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- 25 - 50 µg/m³
- 50 - 100 µg/m³
- > 100 µg/m³

Annual average PM_{10} concentrations
- 0.5 µg/m³
- 1 µg/m³
- 2.5 µg/m³
- 5 µg/m³
- 10 µg/m³
- 25 µg/m³

Annual average PM_{10} concentration range
- 0.5 - 1 µg/m³
- 1 - 2.5 µg/m³
- 2.5 - 5 µg/m³
- 5 - 10 µg/m³
- 10 - 25 µg/m³
- > 25 µg/m³

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55

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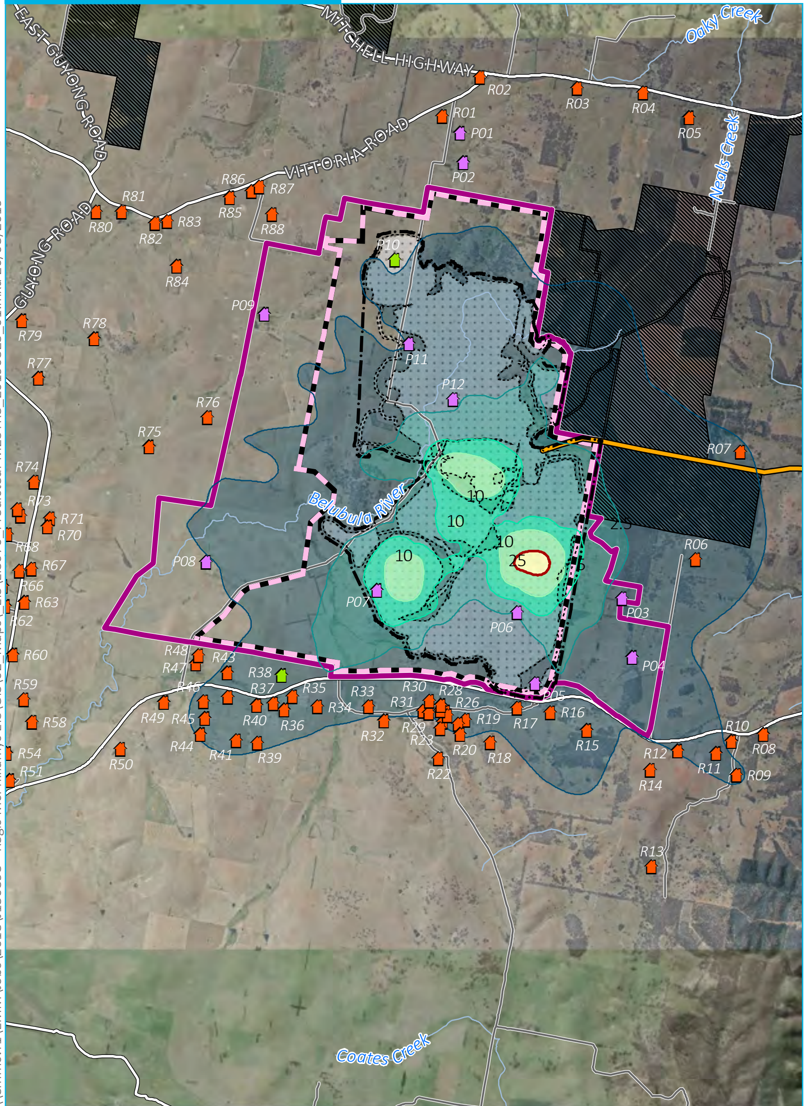
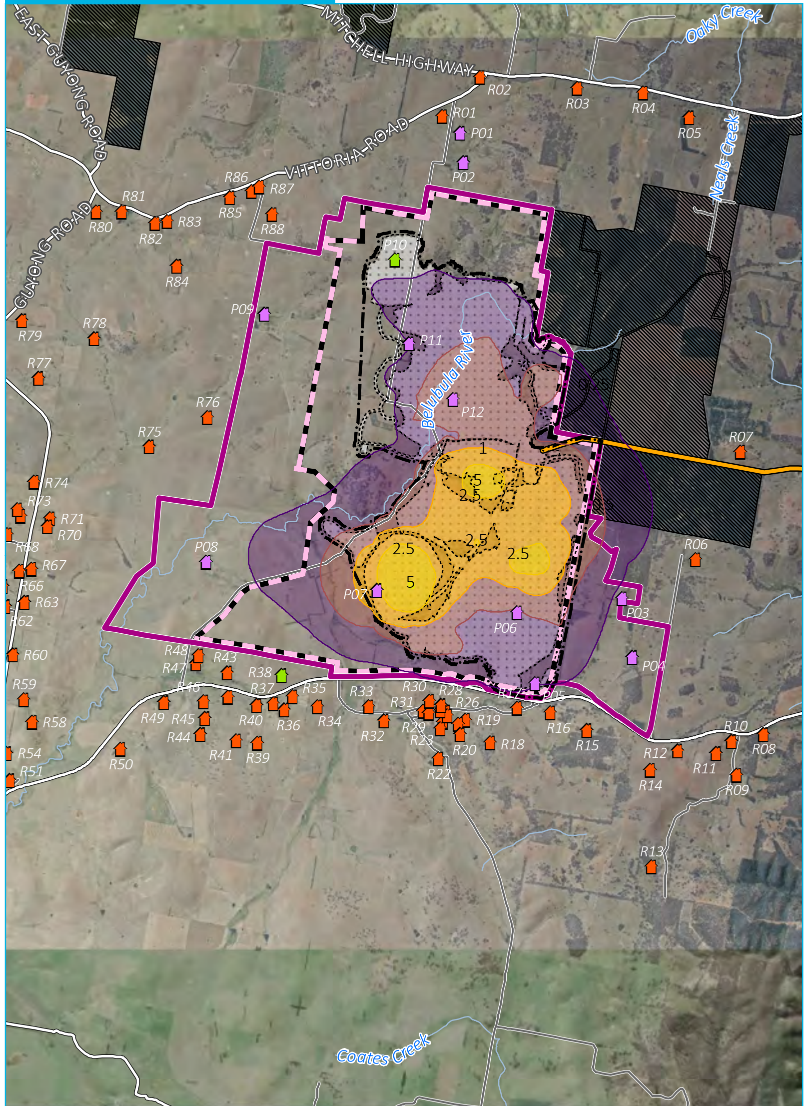
Predicted PM_{10} concentrations (µg/m³) - Year 8 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.20

24-HOUR AVERAGE PM$_{2.5}$ CONCENTRATION



ANNUAL AVERAGE PM$_{2.5}$ CONCENTRATION



24-hour average PM$_{2.5}$ concentrations

- 1 μg/m³
- 2.5 μg/m³
- 5 μg/m³
- 10 μg/m³
- 25 μg/m³ (incremental VLAMP criteria)

24-hour average PM$_{2.5}$ concentration range

- 1 - 2.5 μg/m³
- 2.5 - 5 μg/m³
- 5 - 10 μg/m³
- 10 - 25 μg/m³
- > 25 μg/m³

Annual average PM$_{2.5}$ concentrations

- 0.25 μg/m³
- 0.5 μg/m³
- 1 μg/m³
- 2.5 μg/m³
- 5 μg/m³

Annual average PM$_{2.5}$ concentration range

- 0.25 - 0.5 μg/m³
- 0.5 - 1 μg/m³
- 1 - 2.5 μg/m³
- 2.5 - 5 μg/m³
- > 5 μg/m³

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor
- Mine development general arrangement - Year 8

Existing environment

- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor

- Private
- Residences under option
- Project related (Regis-owned)

Predicted PM$_{2.5}$ concentrations (μg/m³) - Year 8 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.21

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55
N

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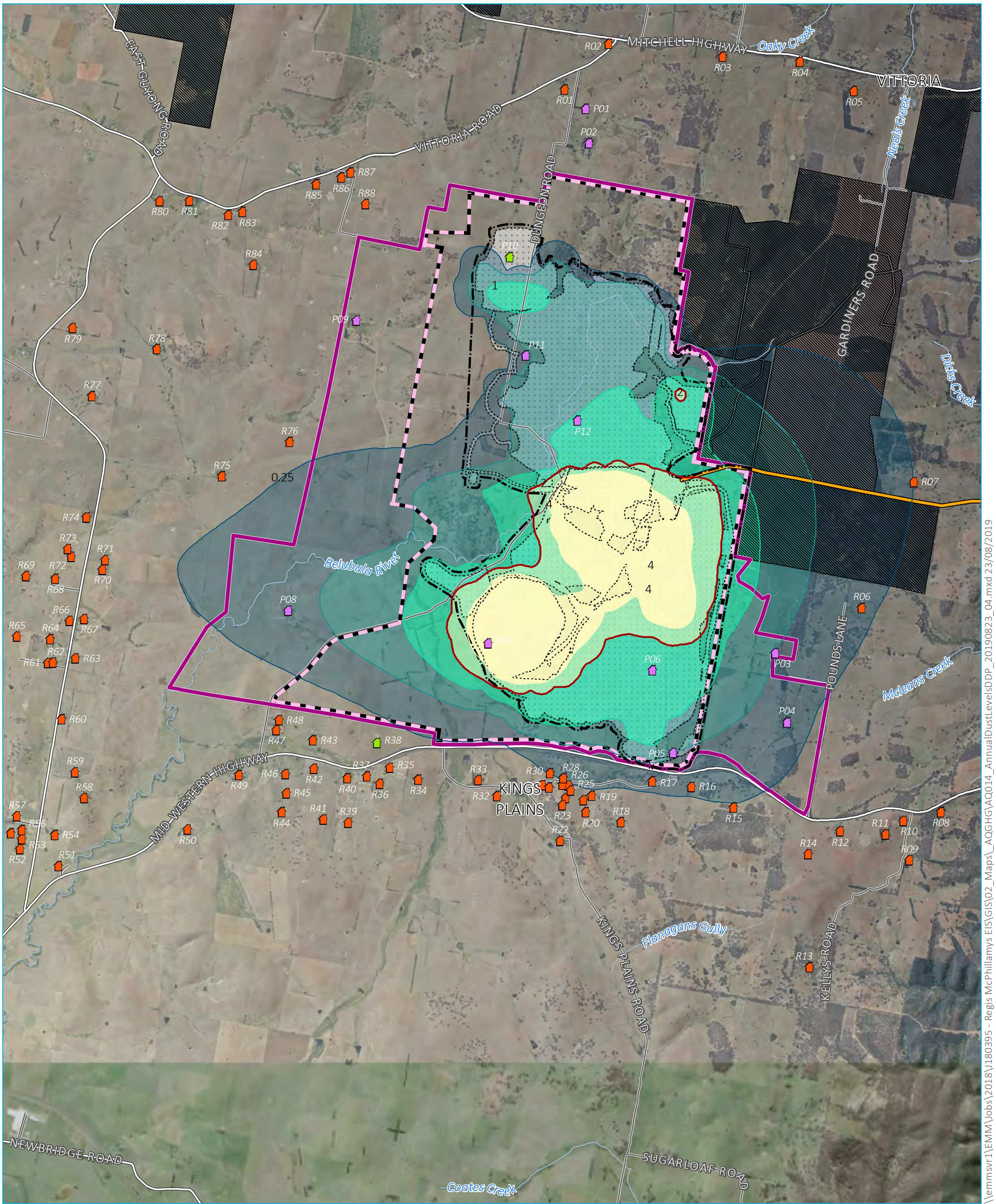

Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- pipeline corridor
- Mine development general arrangement - Year 8

Existing environment
- Main road
- Local road
- Named watercourse
- Vittoria State Forest

Sensitive receptor
- Private
- Residences under option
- Project related (Regis-owned)

Average dust deposition levels
- 0.25 g/m²/month
- 0.5 g/m²/month
- 1 g/m²/month
- 2 g/m²/month (incremental VLAMP mitigation criteria)
- 4 g/m²/month

Average dust deposition level range
- 0.25 - 0.5 g/m²/month
- 0.5 - 1 g/m²/month
- 1 - 2 g/m²/month
- 2 - 4 g/m²/month
- > 4 g/m²/month

Predicted annual average dust deposition levels (g/m²/month) – Year 8 operations only

McPhillamys Gold Project
Environmental impact statement
Figure 11.22

11.4.2 Cumulative (background + mine development) results

Predicted cumulative concentrations and deposition rates for the four modelled scenarios were collated, and the maximum predicted results across the 88 assessment locations are presented in Table 11.8. As shown, As shown the predicted concentrations and deposition rates for all pollutants and averaging periods are below the applicable NSW EPA assessment criteria, with the following exception:

- 24-hour average PM_{10} - a single additional exceedance day at receptor R38 during Year 4 operations.

To better illustrate this exceedance at receptor R38, the daily-varying cumulative concentrations predicted for Year 4 operations are illustrated in Figure 11.23. It is noted that Regis have an option to acquire receptor R38 should the project be approved.

Table 11.8 Summary of highest predicted cumulative (background + mine development) concentrations and deposition levels across all assessment locations

Pollutant	Averaging period	Unit	Year 1	Year 2	Year 4	Year 8	Criterion
TSP	Annual	µg/m³	38.5	40.4	40.1	36.7	90
PM_{10}	3rd highest 24-hour	µg/m³	44.8	47.2	**50.3**	40.8	50
	Annual	µg/m³	16.1	17.1	16.8	14.9	25
$PM_{2.5}$	24-hour maximum	µg/m³	20.0	21.2	21.7	19.2	25
	Annual	µg/m³	6.5	6.7	6.6	6.2	8
Dust deposition	Annual	g/m²/month	1.9	2.2	2.2	1.7	4
NO_2	1-hour maximum	µg/m³	169.6				246
	Annual	µg/m³	14.2				62

Note: Due to two existing exceptional dust storm events in 2017 the third highest cumulative 24-hour average PM_{10} concentration is presented
Note: A single maximum NO_2 modelling scenario based on peak projected diesel consumption was modelled, therefore the same concentrations are presented for all scenarios.

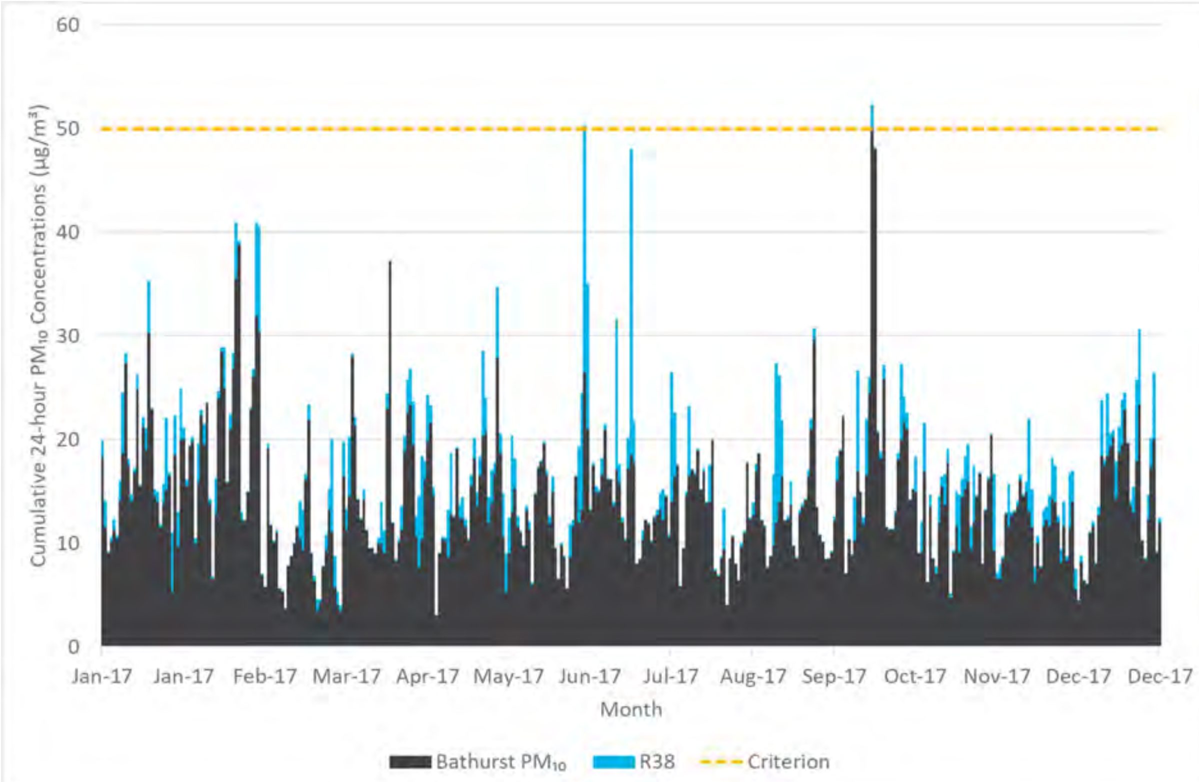

Figure 11.23 Daily-varying cumulative 24-hour average PM_{10} concentrations – Year 4 operations – receptor R38

Figure 11.24 Daily-varying cumulative 24-hour average PM_{10} concentrations – Year 4 operations – receptor R38

11.4.3 Voluntary land acquisition criteria

The results presented in Section 11.4.1 and 11.4.2 demonstrate compliance with the relevant VLAMP criteria for both mitigation and acquisition. As stated, VLAMP criteria also apply if the development contributes to an exceedance on more than 25% of privately-owned land upon which a dwelling could be built under existing planning controls.

Analysis of the contour plots presented in Figures 11.8 to 11.22 indicate that project-only 24-hour PM_{10} and $PM_{2.5}$ concentrations will not exceed 50 µg/m³ or 25 µg/m³ across more than 25% of any privately-owned land during any of the four modelled scenarios. To assess against voluntary land acquisition criteria for cumulative annual average PM_{10}, $PM_{2.5}$, TSP or dust deposition, the relevant fixed background value (as presented in Section 11.2.5) was added to the incremental contour plots. This analysis showed that no exceedance of relevant VLAMP criteria across more than 25% of any privately-owned land would occur for the modelled scenarios.

11.4.4 Blast fume assessment

An assessment of the predicted emissions from blasting at the mine was also undertaken. Emissions of NO_x from blasting operations at the project were quantified for an anticipated maximum potential blast size and used to model potential blast-related NO_2 concentrations in the surrounding environment.

The results found that emissions of NO_2 at the nearest sensitive receptors will be within the relevant EPA criteria during the hours of 8 am to 4 pm.

However, some exceedances are predicted to occur outside these hours during the early morning/late afternoon when the winds are blowing towards the houses in Kings Plains. Therefore, Regis will commit to only blasting in the hours between 8 am and 4 pm. Blasting at the mine outside these hours would only be carried out in consultation with the EPA and in favourable wind conditions, when it can be demonstrated that it is necessary to proactively manage safety and environmental issues.

11.5 Mitigation and monitoring

11.5.1 Particulate matter emission reduction factors

In order to control particulate matter emissions from the mine development, Regis will implement a range of mitigation measures and management practices, including the following:

- chemical dust suppressants will be applied to high traffic routes exiting the pit to the ROM pad and to the waste rock emplacement. All other unpaved transport routes (eg pit, ramps, topsoil haulage) will be controlled through water suppression;
- a road speed limit of 60 km/hr will be posted to all internal roads; however, it is noted that the average travel speed of material haul trucks is less than 40 km/hr;
- the design of crushers, screens and associated transfer points at the processing circuit will include dust control, dust extraction and / or filter systems;
- all exposed conveyors at the processing circuit will be covered;
- water sprays will be utilised at the ROM pad hopper / primary crusher dump pocket;
- ROM pad operations will be controlled through the use of water carts and / or water sprays;
- the fine ore stockpile will be covered;
- in pit drill rigs will be fitted with dry filter capture devices;
- wet suppression via water carts will be applied to dozer activity areas for waste rock and topsoil operations; and
- topsoil stockpiles, waste rock dumps and TSF walls will be progressively rehabilitated through hydro mulching, hydro seeding, or something similar.

In relation to chemical dust suppressants, there are a number of products on the market that could be used. Regis commits to the selection of a product that is both environmentally friendly for human and ecological impacts and achieves the required particulate matter emission reduction. The use of chemical suppressants is widespread at mining operations across NSW and are proven as an effective dust control measure, while also protecting the surrounding environment, in particular workers in close proximity to product application.

In November 2011, the OEH published the guideline *Coal Mine Particulate Matter Control Best Practice Site-specific determination* (OEH, 2011). This guideline document provides detail of the process to follow when conducting a site-specific determination of best practice measures to reduce emissions of particulate matter from coal mining activities. While not specifically related to this project, a comparison of the proposed dust control measures at the mine development with best practice dust management techniques, consistent with this guideline, has been undertaken. Best practice dust control measures have been collated from the following documents:

- *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone, 2011); and

- *Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries* (European Commission, 2017).

The review of proposed dust control measures for the mine development with best practice measures is presented in Table 11.9. The best practice management analysis demonstrated that the mitigation measures proposed are in compliance with accepted best practice for dust control. The relevant emission reduction factors were applied to annual emission calculations for each emissions scenario where applicable.

11.5.2 Diesel combustion emissions

The following management practices will be implemented by Regis to minimise emissions from the combustion of diesel during the life of the mine development:

- where feasible, equipment compliant with a more recent emission standard than USEPA Tier 2 will be sourced;

- the use of electricity-powered mining equipment will be considered during detailed design;

- open cut pit haulage ramps will be designed to reduce the gradient of travel as much as is feasible;

- haul roads will be routinely maintained to reduce truck tyre rolling resistance;

- the distance of material haulage to ROM pad and waste rock dumps will be optimised to reduce haulage distances wherever practicable;

- all equipment will be routinely serviced to maintain manufacturers' emission specifications;

- idling of diesel equipment will be minimised wherever practicable; and

- low-sulphur diesel fuels and lubricants will be used where feasible.

Table 11.9 Best practice particulate matter control measures review for the mine development

Emissions source category	Best practice control measures (Katestone, 2011 and Europe BREF, 2017)	Proposed for implementation at mine development	Comments
Conveyors and transfers	Application of watering at transfer points	Yes	Watering will be implemented at the dump pocket of the primary gyratory crusher. This application will enable carry over moisture through the conveying and transfer process
	Enclosure of transfer points	Yes	All exposed conveyors and transfers will be covered
	Wind shielding of conveyor belts – roof and/or side wall	Yes	All exposed conveyors and transfers will be covered
	Belt cleaning and spillage minimisation	Yes	While not quantified in the emission calculations for this assessment, a belt scraping has been incorporated into the design of the mine development
Unpaved haul roads	Surface treatment - watering	Yes	All unpaved haulage routes will be routinely treated with water for dust suppression via water carts
	Surface treatment - chemical suppressants	Yes	Surface of high -traffic areas will be treated with chemical suppressants
	Surface improvements - low silt aggregate	No	Not practicable for size and scale of the mine development to import specific material for haul roads. Unpaved roads at site will be constructed using extracted waste rock material
	Surface improvements - pave the surface	Partial	The first 1000 m of the main access road off the Mid Western Highway will be sealed. There is a wheel washdown bay allowed for adjacent to the gatehouse for truck tyre washing prior to existing the site. Paving all roads across the site is not practicable due to size and scale of the mine development
	Reduction in vehicle travel speed	Yes	A road speed limit of 60 km/hr will be posted to all internal roads; however, it is noted that the average travel speed of material haul trucks is less than 40 km/hr
	Use larger vehicles rather than smaller vehicles to minimise number of trips	Yes	Haul trucks for waste rock and ore haulage are approximately 180 t in capacity
	Use conveyors in place of haul roads	No	Not practicable to replace haul trucks from pit with conveyors due to planned progression of the mine development
Wind erosion - exposed areas and overburden emplacements	Avoidance - Minimise pre-strip areas	Yes	The mine development will feature a staged development. Areas will not be cleared until the necessary to reduce the extent of exposed surfaces at any given time
	Surface stabilisation - Watering	No	Not practicable for size and scale of exposed areas at the mine development
	Surface stabilisation - Chemical suppressants	No	Not practicable for size and scale of exposed areas at the mine development

Table 11.9 Best practice particulate matter control measures review for the mine development

Emissions source category	Best practice control measures (Katestone, 2011 and Europe BREF, 2017)	Proposed for implementation at mine development	Comments
	Surface stabilisation - Paving and cleaning	No	Not practicable for size and scale of exposed areas at the mine development
	Surface stabilisation - armour with gravel	No	Not practicable for size and scale of exposed areas at the mine development
	Surface stabilisation - Rehabilitation	Yes	Exposed areas, topsoil stockpiles and completed waste rock dump areas will be progressively hydro mulched and seeded for rehabilitation where practical throughout the life of the mine development
	Wind speed reduction - fencing, bunding, shelterbelts or in-pit dumps	Yes	Priority construction of the southern end of the waste rock emplacement in the first few years of the mine development (to act as a noise and visual bund) will provide wind breaks for the active areas of the waste rock dump
	Wind speed reduction - vegetative ground cover	Yes	Progressive rehabilitation of exposed surfaces, topsoil stockpiles and waste rock dump will provide vegetative cover for exposed areas
Wind erosion from ore material stockpiles	Avoidance - bypassing stockpiles	Partial	Approximately 20% to 30% of ROM ore material will be directly dumped to the processing plant hopper. However, ore material stockpiles are a necessary component of the mine development
	Surface stabilisation - watering	Yes	ROM pad will feature water sprays and /or water carts for dust suppression
	Surface stabilisation - chemical suppressants and crusting agents	No	Not practicable given stockpiles are continually accessed
	Surface stabilisation - carry over from wetting from load in	Yes	ROM pad will feature water sprays and water carts for dust suppression. Material handling at the ROM pad will therefore have moisture carryover
	Enclosure - silo with baghouse	No	ROM stockpile is continually accessed, and enclosure is not practicable
	Enclosure - cover storage pile with tarp during high winds	No	ROM stockpile is continually accessed, and tarping is not practicable
	Wind speed reduction - vegetative wind breaks	No	Not practical for ROM pad area design
	Wind speed reduction - reduced pile height	No	Not practical for ROM pad area design
	Wind speed reduction - wind screens/wind fences	No	Not practical for ROM pad area design

Table 11.9 Best practice particulate matter control measures review for the mine development

Emissions source category	Best practice control measures (Katestone, 2011 and Europe BREF, 2017)	Proposed for implementation at mine development	Comments
	Wind speed reduction - pile shaping/orientation	No	Not practical for ROM pad area design
	Wind speed reduction - three-sided enclosure around storage piles	Partial	A covered fine ore stockpiling area will be a feature of the ROM/processing area, however enclosure of the main ROM stockpile is not practicable
Bulldozers	Minimising travel speed and distance	Yes	Bulldozer operations will be generally restricted to immediate working areas
	Keep travel routes and materials moist	Yes	Water carts will supply wet suppression to travel routes and working areas
Blasting	Design - Delay shot to avoid unfavourable weather conditions	Yes	Blasting will be conducted in strict accordance with a blast management plan. The BMP will detail adverse weather conditions to be avoided for both noise and air impacts
	Design - Minimise area blasted	Yes	Blasting will be planned to meet project demands. Size of blasts will be limited to manage the amount of disturbed material generated at any one time
Drilling	Dry collection	Yes	Dry bag filters will be used at drill rigs
	Wet suppression - water injection	No	Water will be applied in the vicinity or the active pit, however dry collection will be the specific focus for drilling operations
Loading and dumping waste rock	Excavator - minimise drop height	Yes	Wherever possible, material drop heights will be minimised when loading trucks with waste rock material in the pit
	Truck dumping - minimise drop height	Yes	Wherever possible, material drop heights will be minimised when unloading trucks at the waste rock emplacement.
	Truck dumping - water application	No	Water carts will supply wet suppression to travel routes and working areas at the waste rock emplacement; however, specific water application to unloading trucks is unlikely to be practical
	Truck dumping - modify activities in windy conditions	Yes	Dumping of material at the waste rock emplacement will be conducted behind an acoustic/visual bund. Dumping of material will occur at lower levels during periods of elevated winds in the direction of sensitive receptors
Loading and	Avoidance - bypassing stockpiles	No	Not practicable given stockpiles are necessary for the mine development

Table 11.9 Best practice particulate matter control measures review for the mine development

Emissions source category	Best practice control measures (Katestone, 2011 and Europe BREF, 2017)	Proposed for implementation at mine development	Comments
dumping ROM ore	Truck dumping - minimise drop height	Yes	Wherever possible, material drop heights will be minimised when unloading trucks at the waste rock emplacement
	Truck dumping - water sprays at ROM pad	Yes	Automated water spray system will be fitted to the ROM hopper unloading point
	Truck dumping - three sided enclosure at truck unloading ROM hopper	No	Automated water spray system will be fitted to the ROM hopper unloading point
Processing	Enclose pre-treatment areas and transfer systems for dusty materials	Yes	All exposed conveyers and transfers will be covered. All crushing and screening will be enclosed, or emissions directed to a baghouse or wet sump arrangement.
	Connect pre-treatment and handling operations to dust collectors or extractors via hoods and a ductwork system for dusty materials	Yes	Emissions directed to a baghouse or wet sump arrangement.
	Electrically interlock pre-treatment and handling equipment with their dust collector or extractor, in order to ensure that no equipment may be operated unless the dust collector and filtering system are in operation	Yes	Processing circuit emissions capture technology will be fitted with alert signals should collection system malfunction

11.5.3 Blasting

As described in Section 11.4.4, blasting will be limited to within the hours between 8 am and 4 pm. Blasting at the mine outside these hours would only be carried out in consultation with the EPA and in favourable wind conditions, when it can be demonstrated that it is necessary to proactively manage safety and environmental issues.

In addition, the risk of post-blast fume will be mitigated through the implementation of the following measures, as appropriate:

- as part of the development of the blast management plan for the mine, a blast fume risk assessment will be undertaken, taking into account ground conditions, occurrence of water (wet holes and depth of water), explosives products and their applications and prevailing and forecast meteorology;
- reduce the potential for fume by:
  - delaying blasting to avoid unfavourable weather conditions that are likely to cause or spread a blast fume, including unfavourable ground moisture conditions;
  - selecting an explosive product that is correct for the conditions;
  - monitoring the amount of hydrocarbon (diesel) in the product;
  - preventing water ingress into blast holes;
  - keeping sleep time (the amount of time between charging and firing of a blast) to a minimum, well within manufacturer recommended times;
  - providing effective stemming; and
  - loading the product using the appropriate techniques.
- restrict the blast area and the quantity of explosives to be used in areas prone to blast fume; and
- investigate and record causal factors for post-blast fume events.

11.5.4 Air quality monitoring

As discussed in Section 11.2, Regis has established an air quality monitoring network comprising a HVAS (PM_{10}), dust deposition gauges and a meteorological monitoring station. The monitoring locations will be reviewed prior to the commencement of operations.

In addition, a real-time particulate matter monitoring network (PM_{10}) will be installed and maintained during the life of the project. This network will feature real-time monitoring locations in the Kings Plains area to the south-west, central south and south-east of the project area. Additionally, monitoring locations will be established to the east and to the west of the project area. Specific monitoring locations will be finalised taking Australian Standard guidance, land access and mains power access into consideration. This network will provide Regis with comprehensive upwind and downwind monitoring based on the dominant wind directions. In combination with data from the existing meteorological monitoring station and project-specific trigger conditions, the real-time monitoring network will be used to inform reactive management practices to prevent adverse impacts at sensitive receptors.

Daily and annual average PM_{10} concentrations and monthly average dust deposition results will be recorded and reported in annual environmental management reports (the Annual Review) and made available to the public through Regis's website.

To support the air quality monitoring network, an air quality monitoring plan will be developed for the mine development, documenting monitoring locations, monitoring methods and reporting responsibilities.

11.6 Conclusions

Dispersion modelling was undertaken for four stages over the proposed life of the mine. The results of the modelling show that, for all assessed stages of the mine development and operation, the predicted concentrations and deposition rates for particulate matter (TSP, PM_{10}, $PM_{2.5}$, dust deposition, metals and metalloids) and gaseous pollutants (NO_2 and HCN) are below the applicable impact assessment criteria at neighbouring sensitive receptors. Cumulative impacts were assessed by combining modelled mine-related impacts with recorded ambient background levels. The cumulative results also demonstrated compliance with applicable impact assessment criteria, with the exception of R38 (as noted above Regis have an option to acquire receptor R38 should the project be approved) despite a range of conservative assumptions in the emission calculations and dispersion modelling techniques.

The design of the mine development incorporates a range of dust mitigation measures. A review of dust control measures was undertaken for the mine development, and this identified that the proposed mitigation and management measures will be in accordance with accepted industry best practice. On the basis of the modelling predictions, the proposed mitigation measures will effectively control emissions from the mine to minimise impacts on the surrounding environment.

Chapter 12

Greenhouse gas

REGIS RESOURCES LTD

12 Greenhouse gas

12.1 Introduction

This chapter summarises the predicted greenhouse gas (GHG) emissions associated with the mine development, in accordance with the relevant EARs, including proposed measures to reduce GHG emissions where possible throughout the mine life. The specific assessment requirements relating to GHG are presented in Table 12.1.

A detailed assessment which addresses the requirements listed in Table 12.1 is provided in Appendix M and summarised in this chapter. As described in the following sub-sections, GHG emissions from the mine development are predicted to be minimal, only making minor contributions to the total GHG emissions from NSW and Australia.

Table12.1 Greenhouse gas related EARs for the mine development

Requirement	Location in report
– an assessment of the likely greenhouse gas impacts of the development;	This chapter and the GHG assessment in Appendix M.
– a description of the feasibility of measures that would be implemented to monitor and report on the emissions (including fugitive dust and greenhouse gases) of the development;	Section 12.5

The GHG assessment was undertaken in accordance with the following regulations, methods and guidance documents:

- *Commonwealth National Greenhouse and Energy Reporting Act 2007* (NGER Act);
- *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines* (DoE 2014a); and
- *National Greenhouse Accounts Factors (NGAF) workbook* (DoEE 2018).

For accounting and reporting purposes, GHG emissions are defined as ‘direct’ and ‘indirect’ emissions. Direct emissions (also referred to as Scope 1 emissions) occur within the boundary of an organisation and as a result of that organisation’s activities. Indirect emissions are generated because of an organisation’s activities but are physically produced by the activities of another organisation (DoEE 2018). Indirect emissions are further defined as Scope 2 and Scope 3 emissions. Scope 2 emissions occur from the generation of the electricity purchased and consumed by an organisation. Scope 3 emissions occur from all other upstream and downstream activities, for example the downstream extraction and production of raw materials or the upstream use of products and services.

According to Bhatia et al 2010, Scope 3 is an optional reporting category and should not be used to make comparisons between organisations, for example in benchmarking GHG intensity of products or services. Notwithstanding, Scope 3 emissions have been predicted for the mine development. Typically, only major sources of Scope 3 emissions are accounted and reported by organisations. Specific Scope 3 emission factors are provided in the NGAF workbook for the consumption of fossil fuels and purchased electricity, making it straightforward for these sources to be included in a GHG inventory, even though they are a relatively minor source.

12.2 Emission sources

The GHG emission sources included in this assessment are listed in Table 12.2, representing the most significant sources associated with the mine development.

Emissions of GHGs have been quantified on an annual basis accounting for the construction, operational and rehabilitation phases of the mine development. In the absence of detailed fuel and energy consumption details for the rehabilitation phase at the time of reporting, the 'year one' construction phase fuel and energy consumption have been adopted for the calculation of annual rehabilitation GHG emissions.

GHG emissions from the mine were estimated using the methodologies outlined in the NGAF workbook, using fuel energy contents and scope 1, 2 and 3 emission factors for diesel, LPG, and electricity use in NSW.

Table 12.2 Scope 1, 2 and 3 emission sources for the mine development

Scope 1	Scope 2	Scope 3
Direct emissions from fuel combustion (diesel) by onsite plant and equipment.	Indirect emissions associated with the consumption of purchased electricity	Indirect upstream emissions from the extraction, production and transport of diesel and petrol
Direct emissions from fuel combustion (LPG) by kiln and furnace at the processing plant		Indirect upstream emissions from electricity lost in delivery in the transmission and distribution network.

There are a number of GHG emissions that are considered minor relative to the emission sources listed in Table 12.2 and were therefore excluded from the GHG assessment. These include:

- fugitive leaks from high voltage switch gear and refrigeration (Scope 1);
- land use change and land clearing (Scope 1);
- disposal of solid waste at landfill (Scope 3);
- transport of product to market (Scope 3); and
- travel of employees to and from the mine (Scope 3).

In the case of land use change, it is considered that the GHG emissions generated by the changes to the land use in the establishment of the mine will be offset by the rehabilitation of the site at the end of the mine life.

12.3 Emission estimates

The following emission factors have been used to estimate GHG emissions from the mine development:

- diesel consumption on-site (Scope 1) – diesel oil factors from Table 3 of the NGAF workbook (2018);
- LPG consumption (Scope 1) - petrol factors from Table 3 of the NGAF workbook (2018);
- electricity consumption (Scope 2) – NSW Scope 2 emission factor from Table 5 of the NGAF workbook (2018);
- diesel consumption on-site (Scope 3) – diesel oil factor from Table 40 of the NGAF workbook (2018);

- LPG consumption on-site (Scope 3) – LPG factor from Table 40 of the NGAF workbook (2018); and
- electricity consumption (Scope 3) - NSW Scope 3 emission factor from Table 41 of the NGAF workbook (2018).

The estimated annual GHG emissions from the mine development for each emission source are presented in Table 12.3.

Table 12.3 Estimated annual GHG emissions for the mine development

Stage of project	Scope 1 (t CO_2-e/year)			Scope 2 (t CO_2-e/year)	Scope 3 (t CO_2-e/year)			
	Diesel	LPG	Total	Electricity	Diesel	LPG	Electricity	Total
Year 1	40,217.1	-	40,217.1	-	2,071.1	-	-	2,071.1
Year 2	51,035.7	901.2	51,936.9	90,258.5	2,628.2	53.9	11,007.1	13,689.2
Year 3	63,592.3	901.2	64,493.5	133,432.0	3,274.8	53.9	16,272.2	19,600.9
Year 4	75,790.5	901.2	76,691.7	133,432.0	3,903.0	53.9	16,272.2	20,229.1
Year 5	111,157.4	901.2	112,058.7	133,797.6	5,724.3	53.9	16,316.8	22,094.9
Year 6	49,266.5	901.2	50,167.8	144,520.8	2,537.1	53.9	17,624.5	20,215.5
Year 7	44,920.2	901.2	45,821.4	148,257.8	2,313.3	53.9	18,080.2	20,447.4
Year 8	33,214.5	901.2	34,115.8	148,257.8	1,710.4	53.9	18,080.2	19,844.6
Year 9	25,266.9	901.2	26,168.1	148,664.0	1,301.2	53.9	18,129.8	19,484.8
Year 10	8,059.4	901.2	8,960.6	125,108.3	415.0	53.9	15,257.1	15,726.0
Year 11	10,728.9	901.2	11,630.1	-	552.5	53.9	-	606.4
Year 12	9,196.2	-	9,196.2	-	473.6	-	-	473.6
Year 13	7,663.5	-	7,663.5	-	394.6	-	-	394.6
Year 14	3,065.4	-	3,065.4	-	157.9	-	-	157.9
Average	**38,083.9**	**643.7**	**38,727.6**	**86,123.5**	**1,961.2**	**38.5**	**10,502.9**	**12,502.6**
Total	**533,174.5**	**9,012.3**	**542,186.9**	**1,205,728.9**	**27,456.9**	**538.8**	**147,040.1**	**175,035.8**

12.4 Impact assessment

The significance of predicted GHG emissions from the mine development relative to state and national GHG emissions is made by comparing annual average GHG emissions against the most recent available total GHG emissions inventories (calendar year 2017[7]) for NSW (128,780.2 kt CO_2-e) and Australia (530,840.9 kt CO_2-e).

Annual average total GHG emissions (Scope 1, 2 and 3) to be generated by the mine represent approximately 0.095% of total GHG emissions for NSW and 0.026% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2017.

The mine development's contribution to projected climate change, and the associated environmental impacts, will be in proportion with its minor contribution to global greenhouse gas emissions.

7 http://ageis.climatechange.gov.au/

12.5 Emission management and mitigation

GHG emissions from the mine will principally be associated with on-site energy consumption, specifically diesel combustion and consumption of purchased electricity. The proposed mining development features conventional drill, blast and haul techniques, which is largely dependent on the use of diesel-powered equipment. Regis is considering the feasibility of electricity-powered shovels for in pit loading operations.

Ultimately, measures and practices designed to improve energy efficiency will assist with the management of project GHG emissions. The diesel combustion management strategies described in the air quality chapter (refer to Section 11.6.2) will equally assist with the reduction of associated GHG emissions.

In order to minimise Scope 3 emissions, the following measures will be adopted by Regis:

- adoption of energy efficient lighting technologies and hot water and air conditioning systems wherever practical;
- use of alternative energy sources where feasible, such as solar power;
- undertaking periodic audits and reviews on the amounts of materials used, amount of mine waste and non-mine waste generated and disposed; and
- sourcing of materials locally where feasible to minimise emissions generated from upstream activities.

In general, opportunities to improve energy efficiency will be investigated on an ongoing basis throughout the life of the project.

The calculated annual Scope 1 and 2 emissions from the mine are greater than the NGER Scheme facility reporting threshold of 25,000 tpa CO_2-e. Consequently, Regis will measure energy consumption, and calculate and report Scope 1 and 2 GHG emissions in accordance with the requirements of the NGER Act.

12.6 Conclusion

GHG emissions from the mine development are predicted to be minimal and make only minor contributions to the total GHG emissions for NSW and Australia. Annual average total GHG emissions (Scope 1, 2 and 3) to be generated by the mine represent approximately 0.095% of total GHG emissions for NSW and 0.026% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2017.


Chapter 13

Terrestrial biodiversity



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13 Terrestrial biodiversity

13.1 Introduction

A biodiversity assessment was undertaken for the mine development by EMM, which assessed the potential impacts on biodiversity and identified measures to avoid, mitigate and/offset any potential impacts. The terrestrial biodiversity assessment report (EMM 2019d) (BAR) is provided in full in Appendix N.

This chapter presents a summary of the BAR, including the assessment methods, existing landscape and terrestrial values, the measures taken to avoid, minimise and mitigate impacts, an assessment of the residual direct and indirect impacts and the offset strategy for terrestrial biodiversity proposed to enable the project to have a net positive biodiversity outcome.

Avoidance and minimisation of impacts on biodiversity have been applied as guiding principles in the design of the mine development. Ecological investigations completed between 2013 and 2019 have enabled a comprehensive knowledge of the project area's biodiversity and areas of low constraint to be identified.

A separate biodiversity assessment has been undertaken for the pipeline component of the project (OzArk 2019b), the results of which are presented in Chapter 27.

As described in Chapter 3, the mine development was determined by DPIE on 16 January 2018 to be a pending or interim planning application under clause 27 of Part 7 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017, provided the development application is made within 18 months of DPIE's determination. Accordingly, the proposed impacts on biodiversity as a result of the mine development have been assessed in accordance with the requirements of the *Framework for Biodiversity Assessment* (FBA) (OEH 2014) under the now repealed TSC Act.

The assessment was also undertaken in accordance with the EARs issued by the DPIE. The biodiversity related EARs, and where they are addressed, are summarised in Table 13.1.

Table 13.1 Biodiversity assessment-related EARs for the mine development

Requirement	Where addressed
An assessment of the direct and indirect biodiversity impacts of the development throughout its life, and impacts on biodiversity values in the region, which:	
- for the open cut mine is assessed in accordance with the Framework for Biodiversity Assessment; and includes a strategy to offset any residual impacts in accordance with the NSW Biodiversity Offsets Policy for Major Projects.	Refer to the BAR in Appendix N (and summarised in this chapter) which addresses the impacts of the mine development, has been prepared in accordance with the reporting and mapping requirements of the FBA and includes an offset strategy to offset residual impacts.
- for the water supply pipeline is assessed in a Biodiversity Development Assessment Report in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method, and includes a strategy to offset any residual impacts in accordance with the Biodiversity Conservation Act 2016 (NSW).	A separate Biodiversity Development Assessment Report and offset strategy has been prepared for the water supply pipeline. The biodiversity development assessment report for the water pipeline is provided as Appendix Y to the EIS and summarised in Chapter 27.

Table 13.1 Biodiversity assessment-related EARs for the mine development

Requirement	Where addressed
- an assessment of the likely impacts of the development on aquatic ecology and key Fisheries issues, including Aquatic Biodiversity and Key Fish Habitats.	A separate aquatic ecology assessment has been prepared to address likely impacts of the mine development on aquatic ecology and key fisheries issues. The aquatic assessment is provided as Appendix O and summarised in Chapter 14.
- an assessment of impacts to koalas and koala habitat in accordance with State Environmental Planning Policy No. 44 – Koala Habitat Protection.	The BAR (refer to Appendix N) provides an assessment on Koalas in accordance with SEPP 44. SEPP 44 is also discussed in Chapter 3 of this EIS.
- a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time.	Section 13.5.2 details the measures incorporated into the design to avoid and minimise impacts on biodiversity, and the proposed measures to manage biodiversity during construction and operation of the mine development.

The mine development was referred to the DoEE in April 2019 and subsequently declared to be a controlled action on 28 May 2019. Supplementary EARs were therefore issued by the EARs on 30 May 2019 to address matters of national environmental significance (MNES) relevant to the mine development. MNES are discussed in Section 13.8.

13.2 Landscape context

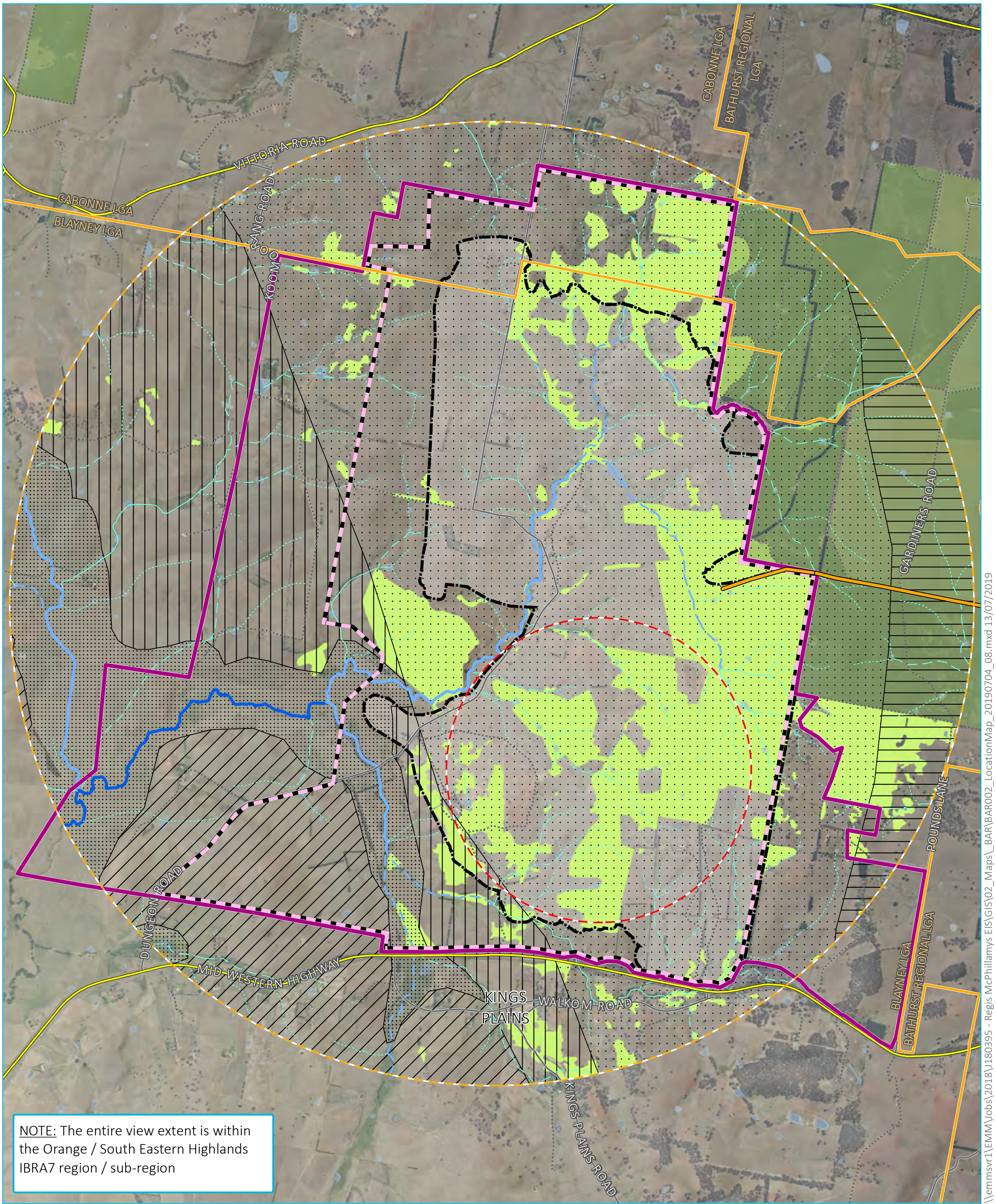
Key landscape attributes relevant to the biodiversity assessment are illustrated in Figure 13.1.

The project area is in the South Eastern Highlands Interim Biogeographic Regionalisation of Australia (IBRA) bioregion, within the Orange IBRA subregion. This IBRA subregion covers the entire project area and is the subregion used in the BAR. The FBA requires the definition of 'assessment circles' (the inner and outer assessment circle) in which the percent native vegetation cover in the landscape is assessed. Both the inner and outer assessment circles for the project area are also entirely within this subregion.

The project area occurs within the Mitchell Landscapes of the Mullion Slopes, Byng Ultramafics, Upper Lachlan Channels and Floodplains, Mandurama Slopes and Rockley Plains Mitchell Landscapes (refer to Figure 7.2 in Chapter 7). The Mullion Slopes Mitchell Landscape was used in biodiversity assessment as it covers most of the project area and disturbance footprint.

In relation to water resources, the mine development is in the upper reaches of the Belubula River catchment, within the greater Lachlan River catchment. One mapped watercourse, the Belubula River, and several smaller tributaries intersect the project area. Thirteen national important wetlands occur in the South Eastern Highlands Bioregion. None of these wetlands occur in the project area.

Vegetation within the project area, which has experienced a long history of pastural use, mainly comprises open paddocks with some fragmented patches of timbered natural vegetation scattered throughout. Regional vegetation mapping by BCD (formally OEH) across the project area and locality (largely based on aerial image interpretation) identifies a range of vegetation communities, including Blakely's Red Gum Yellow Box grassy tall woodland and Broad-leaved Peppermint - Long-leaved Box Woodland of the Tablelands (OEH 2018). The extent of native vegetation cover based on these data sources is shown in Figure 13.1.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); OEH (2017, 2018); DPI (2015); ELVIS (2014)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

Existing environment
- Main road
- Local road
- Vehicular track
- Waterbody
- Vittoria State Forest

- Local government area boundary (LGA)
- Inner assessment circle (400 ha)
- Outer assessment circle (4,000 ha)
- Native vegetation within assessment circles (OEH, 2018)

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Mitchell landscape
- Byng Ultramafics
- Mandurama Slopes
- Mullion Slopes
- Rockley Plains
- Upper Lachlan Channels and Floodplains

Landscape context

McPhillamys Gold Project
Environmental impact statement
Figure 13.1

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EMM creating opportunities

Table 13.2 provides a summary of the extent of native vegetation cover within the inner and outer assessments circles, before and after development, should the project be approved.

Table 13.2 Extent of native vegetation cover before and after the mine development

	Before development		After development	
Assessment circle	**Area (ha)**	**Percentage (%)**	**Area (ha)**	**Percentage (%)**
Outer assessment circle (4000 ha)	660.07	16.5	284.54	7.1
Inner assessment circle (400 ha)	177.53	44.4	0	0

The locality is considered highly fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. This is also consistent with the remaining vegetation within and adjoining the project area.

13.3 Native vegetation

13.3.1 Methods

To confirm the actual extent of native vegetation in the project area, extensive field surveys were undertaken by Envirokey and EMM. Preliminary vegetation mapping and plot/transect surveys were undertaken by EnviroKey between May 2013 and April 2017. This included identification of biometric vegetation types (referred to as plant community types (PCTs)) and stratification of PCTs into vegetation zones. A total of 53 plots were undertaken by EnviroKey across the project area, with 44 of these plots located within the disturbance footprint.

EMM completed the following additional tasks, including further flora surveys in February and March 2019, to further inform the terrestrial biodiversity assessment:

- refinement of vegetation mapping to further stratify PCTs into vegetation zones using data retrieved from plot surveys;
- mapping of vegetation zones to align with condition thresholds under the EPBC Act;
- collection of additional plot/transect data to ensure the minimum requirements of the FBA were met; and
- completion of targeted flora surveys, including transects spaced at 10 m intervals.

Further detail on the filed survey methods is provided in Section 4.2 of the BAR (refer to Appendix N).

13.3.2 Results

The majority of the project area was found to be dominated by open grasslands of varying condition and quality. Most of these areas have been heavily impacted by pastoral activities, particularly grazing, and are dominated by exotic plant species.

Notwithstanding, four PCTs were identified across the disturbance footprint:

- PCT 1330: Blakely’s Red Gum Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion;

- PCT 727: Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion;
- PCT 951: Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion; and
- PCT 766: Carex sedgeland of the slopes and tablelands.

The extent of the PCTs is shown in Figure 13.2, and each PCT is illustrated in Plates 13.1 to 13.5.

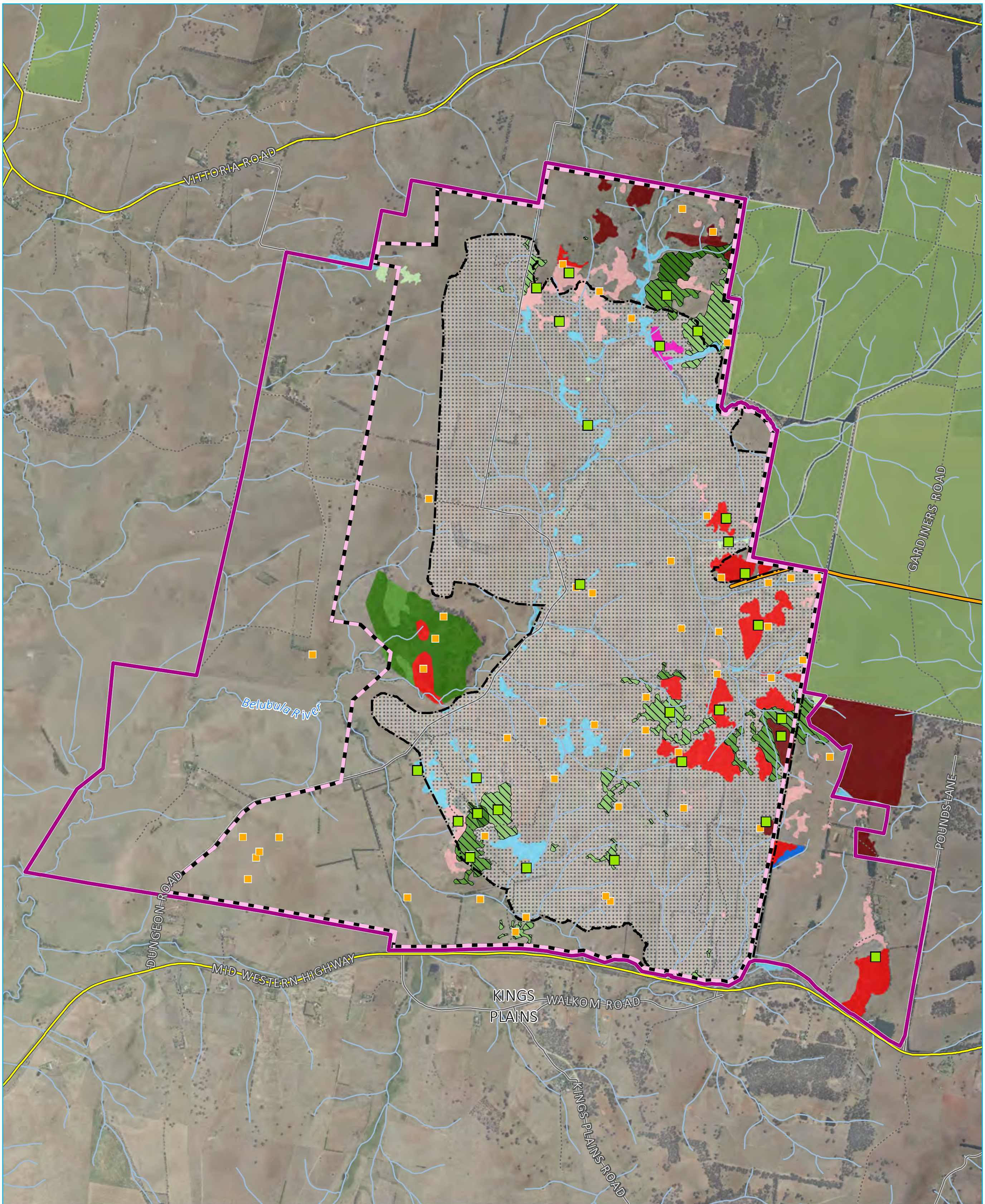
Depending on the condition of these PCTs, they were allocated to a condition class of either Moderate - Good or Low. Within each condition class, an ancillary code of High, Medium, Other or Poor was attributed depending on the condition of vegetation. A list of vegetation zones occurring across the disturbance footprint, including the area of direct impact, is provided in Table 13.3.

Site value scores for wooded vegetation varied between 16.67 and 71.88. Interestingly, plot data from PCT 1330 in moderate/good – high condition derived a very low site value score of 16.67, below the benchmark for offsetting and below expected. The site value score for PCT 766 was 31.16, indicating the level of past disturbance to this PCT.

Areas of open grassland could not be reliably attributed to a PCT given the high level of disturbance. Accordingly, plot and transect data was entered into the BioBanking Credit Calculator for each PCT it could be derived from (ie 1330, 727 and 951) to determine the site value score and if it exceeded the offset threshold of 17. Site value scores ranged from 1.0 to 3.0, indicating the level of past disturbance to these areas, and confirming that regardless of the PCT selected these areas are below the threshold for requiring offsets.

Table 13.3 Vegetation zones in the mine disturbance footprint

PCT ID	PCT name	Condition	Ancillary code	Extent in disturbance footprint (ha)	Site value score
727	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	Mod-Good	High	4.75	71.88
			Medium	34.55	61.98
			Poor	14.25	52.08
951	Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	Mod-Good	Poor	31.55	46.00
766	Carex sedgeland of the slopes and tablelands (LA130)	Mod-Good	Poor	3.04	31.16
1330	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	Mod-Good	High	1.47	16.67
			Medium	17.03	58.85
			Other	0.76	44.27
			Poor	24.96	58.85
Unknown	Open grasslands	Low	–	1002.38	PCT 727: 7.81 PCT 951: 12.00 PCT 1330: 9.38



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); EnviroKey (2017/2018); DFSI (2017); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

- Plot location (EMM, 2019)
- Plot location (EnviroKey, 2017/2018)
- Box Gum Woodland TEC (EMM, 2019)
- Vegetation with a site value score < 17 (1,002.38 ha)

Plant community types (132.35 ha to be cleared)

727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)

766 - Carex sedgeland of the slopes and tablelands
- Moderate/Good (Poor)

951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
- Moderate/Good (Medium)
- Moderate/Good (Poor)

1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)
- Moderate/Good (Other)

Plant community types in the project area

McPhillamys Gold Project
Environmental impact statement
Figure 13.2

Plate 13.1 PCT 1330: Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion within the project area (moderate/good-high)

Plate 13.2 PCT 727: Broad-leaved Peppermint – Brittle Gum – Red Stringybark dry open forest of the South Eastern Highlands Bioregion (moderate/good-high)

Plate 13.3 PCT 951: Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (moderate/good-poor)

Plate 13.4 PCT 766: Wet tussock grasslands of cold air drainage areas of the tablelands (moderate/good-poor)

Plate 13.5 Open grassland in the project area

13.3.3 Threatened ecological communities

PCT 1330 represents White Box Yellow Box Blakely's Red Gum Woodland, which is listed as an endangered ecological community (EEC) under the BC Act as it:

- occurs on fertile soils in the western slopes of NSW;
- is dominated by Yellow Box, a representative canopy species;
- has an understorey comprising grasses and herbs; and
- has a sparse shrub layer.

The National Recovery Plan for White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010c) describes the listed community (under the EPBC Act) as a woodland or derived native grassland, characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, that is dominated by White Box, Yellow Box and/or Blakely's Red Gum. To be considered part of the listed community, remnants must also:

- have a predominantly native understorey (ie more than 50% of the perennial ground layer must comprise native species); and

- be 0.1 ha or greater in size and contain 12 or more native understorey species (excluding grasses), including one or more identified important species; or

- be 2 ha or greater in size and have either natural regeneration of the overstorey species or an average of 20 or more mature trees per ha.

Using the above criteria, polygons of PCT 1330 in moderate/good (high) and moderate/good (medium) meet the criteria for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland listed as a critically endangered ecological community (CEEC) under the EPBC Act, while polygons in moderate/good (poor) and moderate/good (other) do not.

No other PCTs in the project area represent ecological communities listed under the BC and/or EPBC Act.

13.4 Threatened species

13.4.1 Habitat assessment

Land in the project area has been extensively cleared for agricultural purposes. As a result, the disturbance footprint provides limited refuge or habitat for fauna. Fauna habitat features are limited to areas of remnant vegetation, particularly those in higher quality, scattered trees and waterways, and comprise mostly fallen debris, litter cover and some hollow bearing logs. The groundcover consists of a sparse to moderate cover of native grasses like tussock grasses and forbs, with the midstorey mostly absent due to grazing. Riparian vegetation is largely absent and consists of patches of retained trees and willows (*Salix* sp.). Due to stock access, drainage lines are highly degraded and have a high sediment load with little aquatic vegetation.

13.4.2 Candidates species assessment

An assessment of the occurrence of geographic habitat features, in accordance with Section 6.3 of the FBA, was undertaken by EMM (2019d), along with a determination of whether impacts to these habitat features, and species associated with each habitat feature, could result from the mine development. This assessment identified that suitable geographic features exist in the project area for the:

- Small Purple-pea; and

- Booroolong Frog.

These two species were included in the species credit species assessment in Section 13.4.4.

13.4.3 Ecosystem credit species predicted to occur

Ecosystem credit species predicted to occur on site are listed in Table 13.4. To develop this list, PCTs in the project area were entered into the credit calculator associated with the FBA.

Table 13.4 Ecosystem credit species predicted to occur in the mine project area

Species name	Associated vegetation type	Threatened species offset multiplier
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis subsp. gularis*	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	1.3

Table 13.4 Ecosystem credit species predicted to occur in the mine project area

Species name	Associated vegetation type	Threatened species offset multiplier
Brown Treecreeper (eastern subspecies) *Climacteris picumnus subsp. victoriae*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	2.0
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Diamond Firetail *Stagonopleura guttata*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	1.3
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Flame Robin *Petroica phoenicea*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	1.3
	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	-
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Gang-gang Cockatoo *Callocephalon fimbriatum*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	2.0
	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	-
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Hooded Robin (south-eastern form) *Melanodryas cucullata subsp. cucullata*	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	1.7
Little Eagle *Hieraaetus morphnoides*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	1.4
	PCT 766 - Carex sedgeland of the slopes and tablelands (LA130)	-
	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	-
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-

Table 13.4 Ecosystem credit species predicted to occur in the mine project area

Species name	Associated vegetation type	Threatened species offset multiplier
Little Lorikeet *Glossopsitta pusilla*	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	1.8
Painted Honeyeater *Grantiella picta*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	1.3
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Scarlet Robin *Petroica boodang*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	1.3
	PCT 766 - Carex sedgeland of the slopes and tablelands (LA130)	-
	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	-
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Speckled Warbler *Chthonicola sagittata*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	2.6
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Spotted Harrier *Circus assimilis*	PCT 766 - Carex sedgeland of the slopes and tablelands (LA130)	1.4
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Spotted-tailed Quoll *Dasyurus maculatus*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	2.6
	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	-
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
Square-tailed Kite *Lophoictinia isura*	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	1.4

Table 13.4 Ecosystem credit species predicted to occur in the mine project area

Species name	Associated vegetation type	Threatened species offset multiplier
Swift Parrot *Lathamus discolor*	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	1.3
Varied Sittella *Daphoenositta chrysoptera*	PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	1.3
	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	-
	PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	-
White-fronted Chat *Epthianura albifrons*	PCT 766 - Carex sedgeland of the slopes and tablelands (LA130)	0.8
Yellow-bellied Glider *Petarus australis*	PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	2.3

Notes:

Where no value is assigned to the threatened species offset multiplier for a particular species (ie Varied Sittella for PCT 951), it is not a predicted ecosystem credit species associated with that PCT. The presence of these species could not be discounted using the methodology outlined in Section 6.3 of the FBA (OEH 2014). It was therefore assumed that these species may occur within the project area.

The Spotted-tailed Quoll and Speckled Warbler have the lowest Tg values and therefore the highest threatened species offset multipliers.

To account for PCT 1330 not being able to be aligned with White Box Yellow Box Blakely's Red Gum Woodland EEC in the BioBanking Calculator, and therefore deriving an EEC multiplier of 3.0, the threatened species offset multiplier for the Black-chinned Honeyeater was manually increased to 3.0.

13.4.4 Species credit species predicted to occur

To develop a list of species credit species that may occur in the project area, the identified PCTs were entered into the credit calculator associated with the FBA. This assessment identified the following species as candidate species requiring further assessment:

- Hoary Sunray (*Leucochrysum albicans* subsp*. Tricolor)*;
- Small Purple-pea (*Swainsona recta)*;
- Regent Honeyeater (*Anthochaera Phrygia)*;
- Eastern Pygmy-possum (*Cercartetus nanus)*;
- Squirrel Glider (*Petaurus norfolcensis)*; and
- Koala (*Phascolarctos cinereus)*.

Targeted surveys for these species were therefore undertaken, and the presence or absence of these species in the project area determined in accordance with Section 6.6 of the FBA (OEH 2014a). Survey methods and outcomes are discussed further below.

13.4.5 Field surveys

i Targeted flora surveys

Targeted flora surveys were conducted by EnviroKey in 2013 over four sessions in September, October and November, which targeted the Small Purple-pea and the Hoary Sunray. This included walking random or line transects through patches of potentially suitable vegetation (Envirokey 2017).

EMM conducted further targeted flora surveys for the Hoary Sunray in February and March 2019 in accordance with the *Guide to surveying threatened plants* (OEH 2016). This included transects spaced at 10 m intervals within potentially suitable vegetation. EMM consulted with BCD regarding the assessment method for the Small Purple-pea, confirming the 2013 targeted survey was adequate.

Further consultation with BCD identified that the northernmost part of the proposed disturbance footprint in PCT 766 contains habitat suitable for the Silky Swainson-pea (*Swainsona sericea*). The Silky Swainsona-pea was not targeted in flora surveys, as it is not identified as a threatened species requiring consideration by the calculator associated with the FBA for this PCT. Therefore, this species is not considered a candidate species requiring further assessment, in accordance with the method set out in Section 6.5 of the FBA.

ii Targeted fauna surveys

Targeted fauna surveys were conducted by EnviroKey in 2013 and 2014 over six sessions and comprised a range of survey methods (EnviroKey 2017). EMM conducted further targeted fauna surveys from 18 to 22 February 2019 in accordance with relevant NSW and Commonwealth guidelines.

Fauna surveys targeted the Regent Honeyeater, Eastern Pygmy-possum, Squirrel Glider, Koala, Masked Owl, Barking Owl, Bush Stone Curlew and the Little Whip Snake. A summary of the fauna survey methods employed is provided in Table 13.5.

Table 13.5 Summary of fauna survey effort for the mine development

Taxa group	Survey method
Birds	Timed diurnal searches
Nocturnal birds and marsupials	Call playback
Small terrestrial mammals	Elliot trapping Funnel trapping Remote camera
Arboreal mammals	Elliot trapping Spotlighting Spot assessment technique
Microchiropteran bats	Echolocation call recording
Reptiles	Funnel trapping Little Whip Snake targeted searches Herpetofauna searches
Frogs	Funnel trapping Call playback

13.4.6 Targeted survey results

i Threatened flora

No threatened flora species were identified during surveys. All candidate flora species, including the Small Purple-pea and the Hoary Sunray, are considered to have a low likelihood of occurrence within the disturbance footprint.

ii Threatened fauna

Two threatened fauna species credit species were identified in the project area:

- Squirrel Glider (listed as Vulnerable under the BC Act); and
- Koala (listed as Vulnerable under both the BC Act and EPBC Act).

The Squirrel Glider was recorded eight times in PCT 727, 951 and 1330. The project area is considered to hold a low density koala population, as it was recorded once opportunistically but not during spotlighting surveys or from Spot Assessment Technique (SAT) surveys. Two PCTs in the project area are considered to be food tree species for Koala; PCT 951 and PCT 1330. PCT 951 contains Manna Gum, a primary Koala food tree in the central and southern tablelands KMA. PCT 1330 contains secondary food tree species, Apple Box and Yellow Box. The threatened fauna and endangered ecological communities identified in the project area are shown on Figure 13.3.

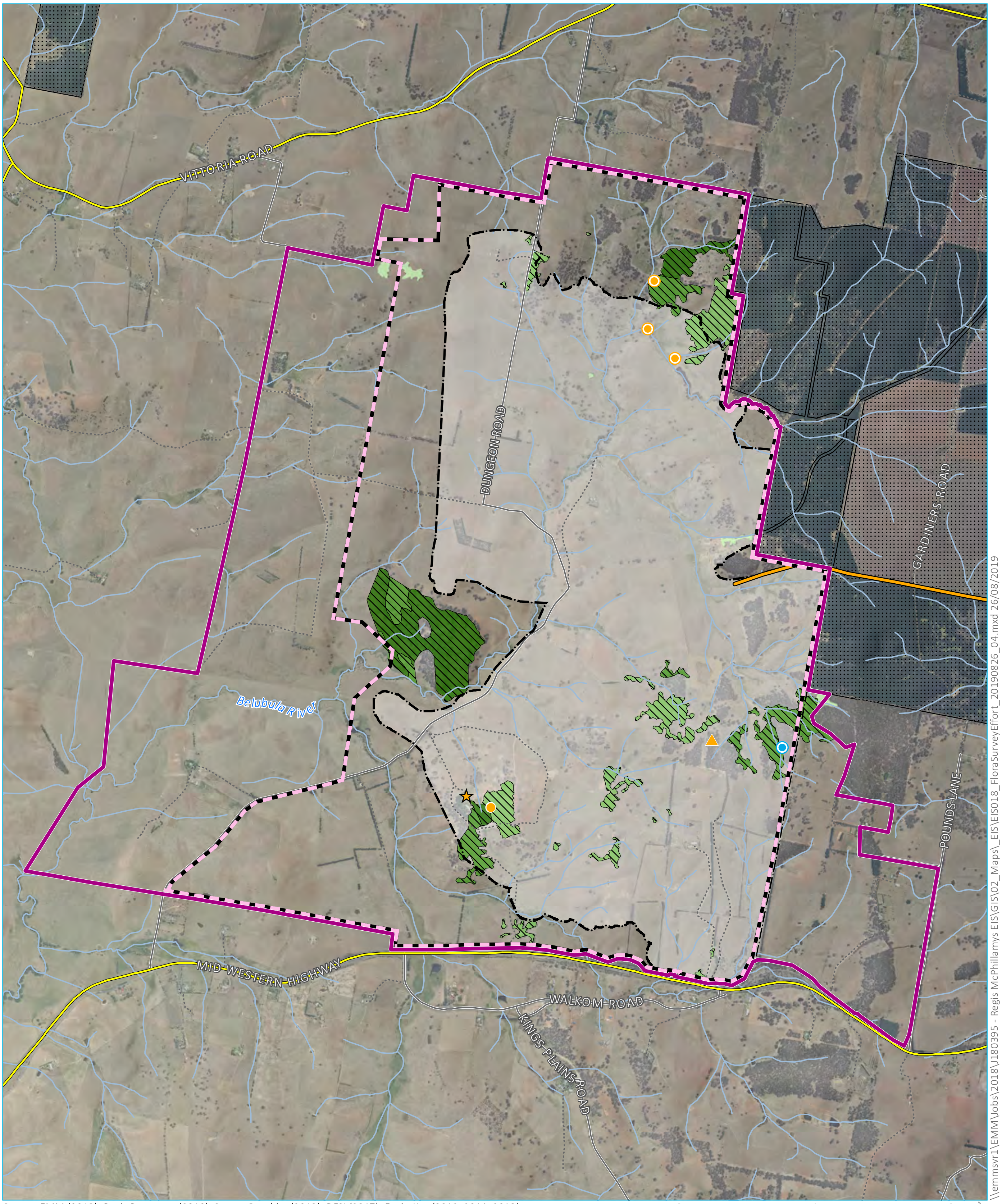
The remaining candidate species, including the Regent Honeyeater and Eastern Pygmy-possum, were not recorded in the project area and are therefore considered to have a low likelihood of occurrence within the disturbance footprint.

13.5 Impact assessment, avoidance and mitigation

13.5.1 Impact assessment

In the absence of mitigation measures, the mine development would have the following direct and indirect impact on biodiversity:

- direct impacts:
  - loss of native vegetation; and
  - loss and degradation of native fauna habitat.
- indirect impacts:
  - alteration to hydrology for groundwater dependent ecosystems;
  - erosion and sedimentation;
  - weed introduction and spread;
  - feral animal invasion into retained habitats;
  - removal of habitat resources for threatened fauna; and
  - removal of hollow-bearing trees.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); EnviroKey (2013, 2014, 2018)

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Threatened fauna species (EMM, 2019)

- Squirrel Glider
- Koala

Threatened fauna species (EnviroKey)

May 2013 sightings

- Squirrel Glider

November 2013 sightings

- Squirrel Glider

March 2014 sightings

- Squirrel Glider

- Box Gum Woodland TEC (EMM, 2019)

Plant community types

1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)
- Moderate/Good (Other)

Threatened fauna and endangered ecological communities recorded in the project area

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Figure 13.3

Avoidance through design has reduced the native vegetation to be cleared by the project from that originally considered in the Preliminary Environmental Assessment (PEA) (R.W Corkery 2018). Following the implementation of these design changes, the direct impacts on biodiversity will be as follows:

- loss of 132.36 ha of native vegetation, of which;
  - 44.22 ha (PCT 1330) represents White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act;
  - 18.5 ha represents White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the Commonwealth EPBC Act; and
- loss and degradation of 129.3 ha native fauna habitat for species credit species, Squirrel Glider and 75.77 ha of which comprises habitat for the species credit species, Koala.

13.5.2 Avoidance and minimisation

The location and design of the open cut pit is highly restricted due to the location of the gold deposit. The site layout is also constrained by the mining lease application area, which was defined so as to avoid any potential biophysical strategic agricultural land (BSAL) in the western portion of the project area.

Regis has carried out annual biodiversity surveys within the project area since 2013. These surveys have been carried out in parallel with, and have informed the evolution of, the mine development design. This process has enabled the avoidance of environmental constraints, including impacts on Box Gum Woodland and threatened species habitat, as far as practicable. During preparation of the PEA, it was determined that approximately 33.5 ha of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands critically endangered ecological community (CEEC) would be cleared. This has been reduced to approximately 18.5 ha through the modification of the mine development boundary and surface facilities.

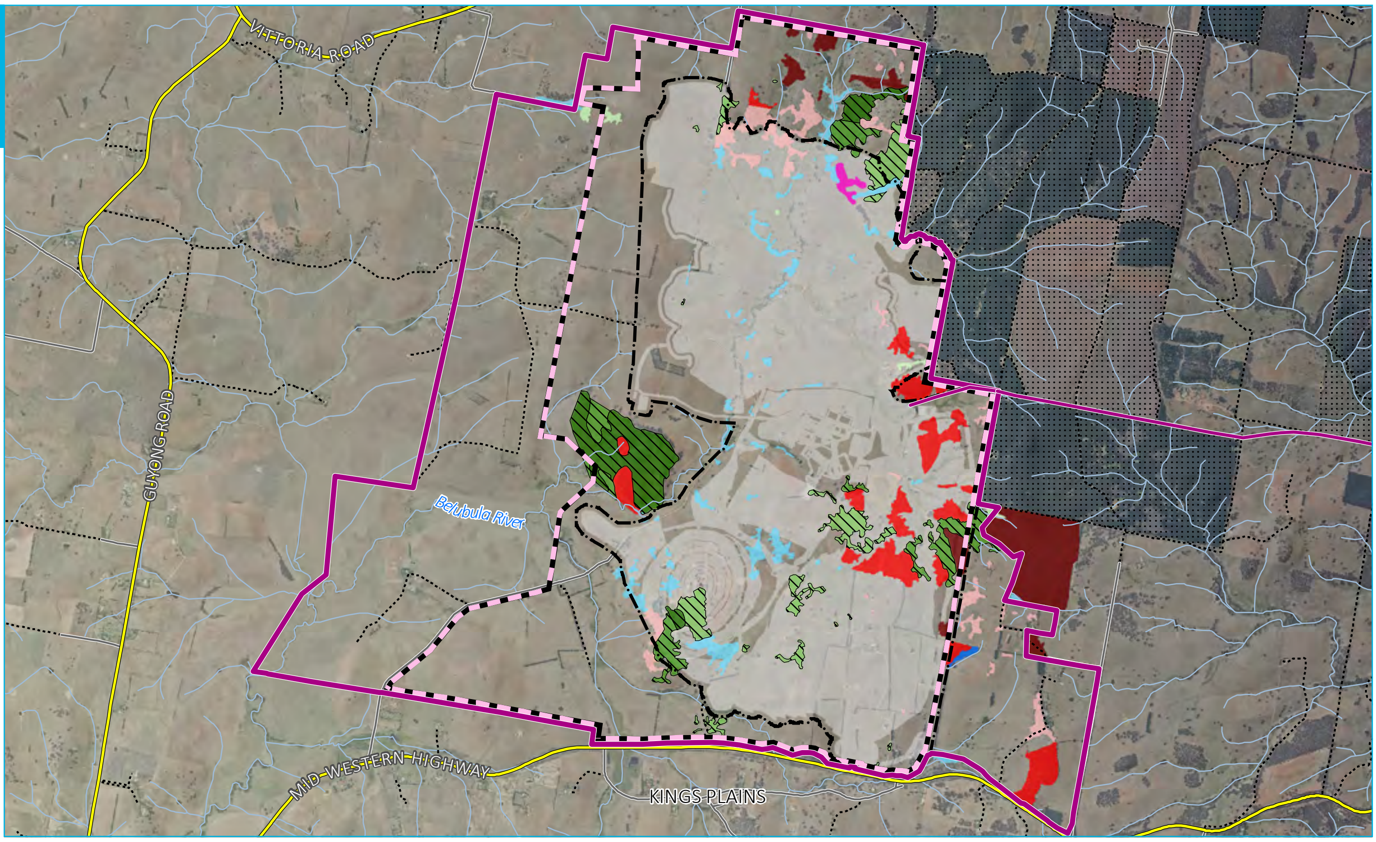
A summary of the key avoidance measures implemented by Regis include:

- avoidance of all areas of PCT 1330 Moderate/Good (High) condition apart from a small area in the direct footprint of the open cut mine;
- minimisation of impacts to PCT 1330 (Moderate/Good (Medium) condition wherever feasible;
- a reduction in the footprint of the TSF through the addition of a northern embankment to avoid 5.1 ha of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC; and
- positioning of the secondary water management facility to avoid White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands in the project area.

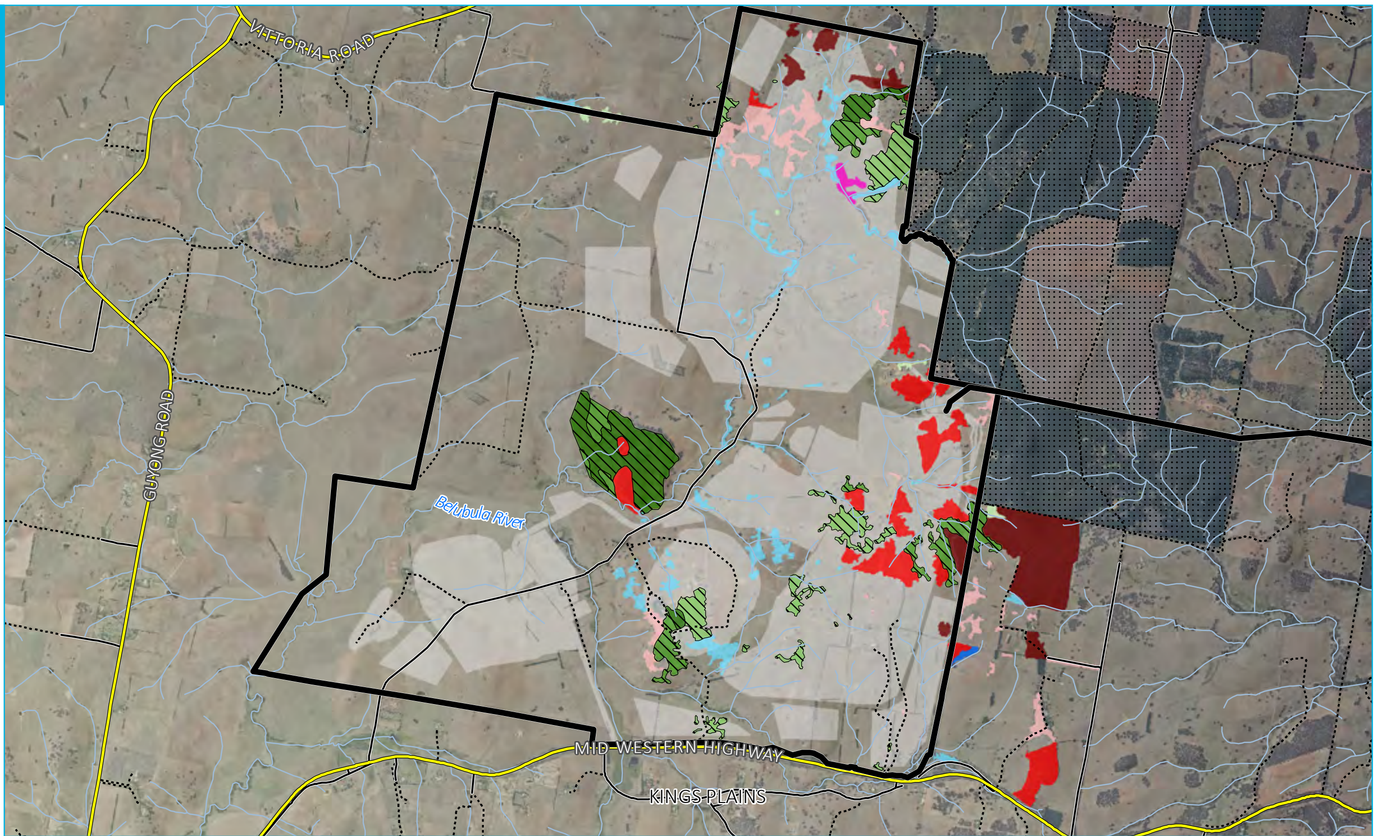
In relation to this last avoidance measure, Regis purchased additional land to the north-west of the original project area, as defined in the PEA, to accommodate the secondary water management facility. This storage is required to ensure the mine development will operate as a no discharge operation and was originally planned to be located to the north of the TSF. However, to avoid the clearance of identified White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC in this area, Regis relocated the storage partially into the newly acquired properties. Due to the prevailing topography, it has not been possible to shift this water storage to completely avoid native vegetation; however, all impact to White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands has been avoided in this portion of the project area.

Figure 13.4 shows the previous and current mine development and demonstrates how the design has evolved to avoid and or minimise impacts on threatened biodiversity.

CURRENT DESIGN



PEA DESIGN



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project general arrangement
- Design lines
- Design polygons

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

PEA design
- PEA site boundary (2,266.60 ha)
- Pipeline optioneering

Existing environment
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State
- Box Gum Woodland TEC (EMM, 2019)

Plant community types

727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)

766 - Carex sedgeland of the slopes and tablelands
- Moderate/Good (Poor)

951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
- Moderate/Good (Medium)
- Moderate/Good (Poor)

1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)
- Moderate/Good (Other)

Mine design evolution and vegetation avoidance

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Environmental impact statement
Figure 13.4

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EMM creating opportunities

13.5.3 Residual impacts

The mine development will result in the clearing of approximately 132.36 ha of native vegetation, 129.3 ha of which is considered habitat for species credit species, Squirrel Glider, and 75.77 ha for Koala. Residual impacts associated with the mine development are summarised in Table 13.6, including the PCT proposed for clearing and associated ecosystem credit species.

Table 13.6 Residual biodiversity impacts of the mine development

PCT	Associated ecosystem credit species (species with highest credit requirement italicised)	Residual impact (ha)
727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion – Moderate/Good (High)	Ecosystem credit species: Brown Treecreeper, Diamond Firetail, Flame Robin, Gang-gang Cockatoo, Little Eagle, Painted Honeyeater, Scarlet Robin, *Speckled Warbler*, Spotted-tailed Quoll, Varied Sittella Species credit species: Koala and Squirrel Glider	4.75
727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion – Moderate/Good (Medium)		34.55
727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion – Moderate/Good (Poor)		14.25
951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion – Moderate/Good (Poor)	Ecosystem credit species: Flame Robin, Gang-gang Cockatoo, Little Eagle, Scarlet Robin, *Spotted-tailed Quoll*, Varied Sittella, Yellow-bellied Glider Species credit species: Koala and Squirrel Glider	31.55
766 - Carex sedgeland of the slopes and tablelands – Moderate/Good (Poor)	Ecosystem credit species: *Little Eagle*, Scarlet Robin, Spotted Harrier, White-fronted Chat	3.04
1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion– Moderate/Good (High)	Ecosystem credit species: Black-chinned Honeyeater, Brown Treecreeper, Diamond Firetail, Flame Robin, Gang-gang Cockatoo, Hooded Robin, Little Eagle, Little Lorikeet, Painted Honeyeater, Scarlet Robin, *Speckled Warbler*, Spotted Harrier, Spotted-tailed Quoll, Square-tailed Kite, Swift Parrot, Varied Sittella Species credit species: Koala and Squirrel Glider	1.47
1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate/Good (Medium)		17.03
1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate/Good (Other)		0.76
1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate/Good (Poor)		24.96
Total		**132.36 (129.3 of which comprises habitat for Squirrel Glider and 75.77 of which comprises habitat for Koala)**

13.5.4 Impacts requiring further consideration

Impacts that require 'further consideration' in accordance with Section 9.2 of the FBA are those that are considered to be complicated or severe. No impacts requiring further consideration were identified in the EARs. Considering this, an assessment of impacts requiring further consideration in accordance with Section 9.2 of the FBA was completed. This included an assessment of impacts to native vegetation, species and populations, and landscape features, the results of which are summarised as follows:

- Native vegetation - PCT 1330 represents White Box Yellow Box Blakely's Red Gum Woodland listed as an EEC under the BC Act. It was not identified in the EARs and therefore does not require further consideration in accordance with section 9.2 of the FBA. Notwithstanding, the impacts to PCT 1330 have been assessed and an offset strategy developed (refer to Section 13.7);

- Species and populations - critically endangered species will not be impacted by the project. Further, no threatened species or populations were nominated in the EARs and as such do not require further consideration; and

- Landscape features: The mine development will impact a 1,382 m length of the 5th order section of the Belubula River and a 3,273 m length of the 4th order section of the Belubula River, equating to 18.62 ha. Vegetation along these 4th and 5th order sections of the Belubula River and the associated tributary consists of PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion. This vegetation occurs as scattered patches of vegetation isolated through clearing for agriculture. Vegetation is in poor condition, with the midstorey absent and groundcover heavily impacted by grazing. This PCT derives a vegetation integrity score of 46, demonstrating this poor condition. Indirect downstream impacts are considered unlikely and are discussed further in Chapter 14 (aquatic ecology).

13.5.5 Groundwater dependant ecosystems

i Methods

An assessment was completed in conjunction with EMM's groundwater specialists to identify terrestrial ecosystems which potentially utilise and/or are reliant on groundwater in the project area. The assessment included reviewing the Groundwater Dependent Ecosystem Atlas (BOM 2013), groundwater monitoring data and groundwater modelling results against biodiversity values documented in the project area. The groundwater monitoring and modelling methods and results are provided in full in the McPhillamys Gold Project Groundwater Assessment, which forms Appendix K of the EIS.

The groundwater model outputs were used to identify areas where shallow groundwater (0 to 20 m below the ground surface) is available for plants to use in the project area. The average depth at which Eucalypts draw on groundwater is 10 m below the ground surface; however, use up to 20 m has been recorded (Serov 2013) and therefore this deeper figure was used as the maximum depth that PCTs would access groundwater.

Accordingly, the following categories of groundwater uptake were assigned:

- very high interaction: 0 m (+);

- high interaction: 0 – 0.5 m;

- moderate interaction: 0.5 – 2 m;

- low interaction: 2 – 5 m; and

- very low interaction: 5 – 20 m.

Recorded PCTs and regional vegetation mapping (OEH 2018) were then overlaid on the shallow groundwater distribution maps in GIS, to determine which patches could potentially access groundwater. Areas of overlap; that is where native plant communities coincided with shallow groundwater, were identified as 'potential groundwater dependant ecosystems' (GDEs).

Following the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (DPI 2016), potential GDEs were categorised, based on their degree of dependence on groundwater. GDEs are divided into three main categories, comprising:

- non-dependent (ie do not access groundwater);
- facultative (have some degree of dependence on groundwater); and
- entirely dependent/obligate (ie essential to ecosystem functioning).

Ecosystems with a facultative dependence can be further divided into three sub-categories, including:

- opportunistic: these ecosystems will use groundwater where available, but can exist without the input of groundwater, as long as there is no prolonged drought;
- proportional: these ecosystems take a proportion of their water requirements from groundwater; however there is no absolute threshold for groundwater availability below which ecosystem structure or function is impaired, and can respond to changes in groundwater at any level; and
- highly dependent: these ecosystems take a high proportion of their water requirements from groundwater and can only tolerate small changes in groundwater levels for short periods of time.

ii GDEs in the project area

The GDE Atlas (BOM 2013) does not show any terrestrial GDEs as occurring in the project area.

Although terrestrial GDEs are not predicted to occur, parts of PCT 1330, 727 and 951 overlie shallow groundwater from 0 to 20 mbgl and would likely range from having a very high ie (0 + m) to very low (5 – 20 mbgl) interaction with groundwater. Opportunistic GDEs are mainly located north of the TSF, with smaller patches south-west and south-east of the TSF. All other PCTs are considered to be non-dependent as they do not have access to shallow groundwater.

These PCTs represent ecosystems with a facultative and opportunistic dependence on groundwater, in that they would use groundwater where available but can exist without its input, with the exception of times of prolonged drought. The locality is currently in drought. Where soil moisture cannot fulfil the opportunistic GDE's water requirements they would be supplemented by groundwater.

iii Potential impacts to GDEs

In relation to groundwater accessibility, the extent of groundwater drawdown associated with open-cut mining is predicted to be steep and localised around the void and limited in extent to the project area (refer to Chapter 9).

The project is predicted to result in no change to a minor increase around the TSF in the extent of groundwater access for PCTs with a higher level of dependence on groundwater. A minor reduction in the extent of groundwater access is predicted for PCT 951 (0.67 ha, or 13.8% reduction in the extent of groundwater access) and PCT 1330 (0.82 ha, or 0.04% reduction in the extent of groundwater access). Given these minor reductions in the extent of groundwater access and their low to very low interaction and dependence on groundwater (ie between 2 – 20 mbgl), water stress is not predicted to occur.

A summary of the predicted change in access to shallow groundwater across the relevant PCTs in the project area, before and after mining, is presented in Table 13.7 and illustrated in Figure 13.5.

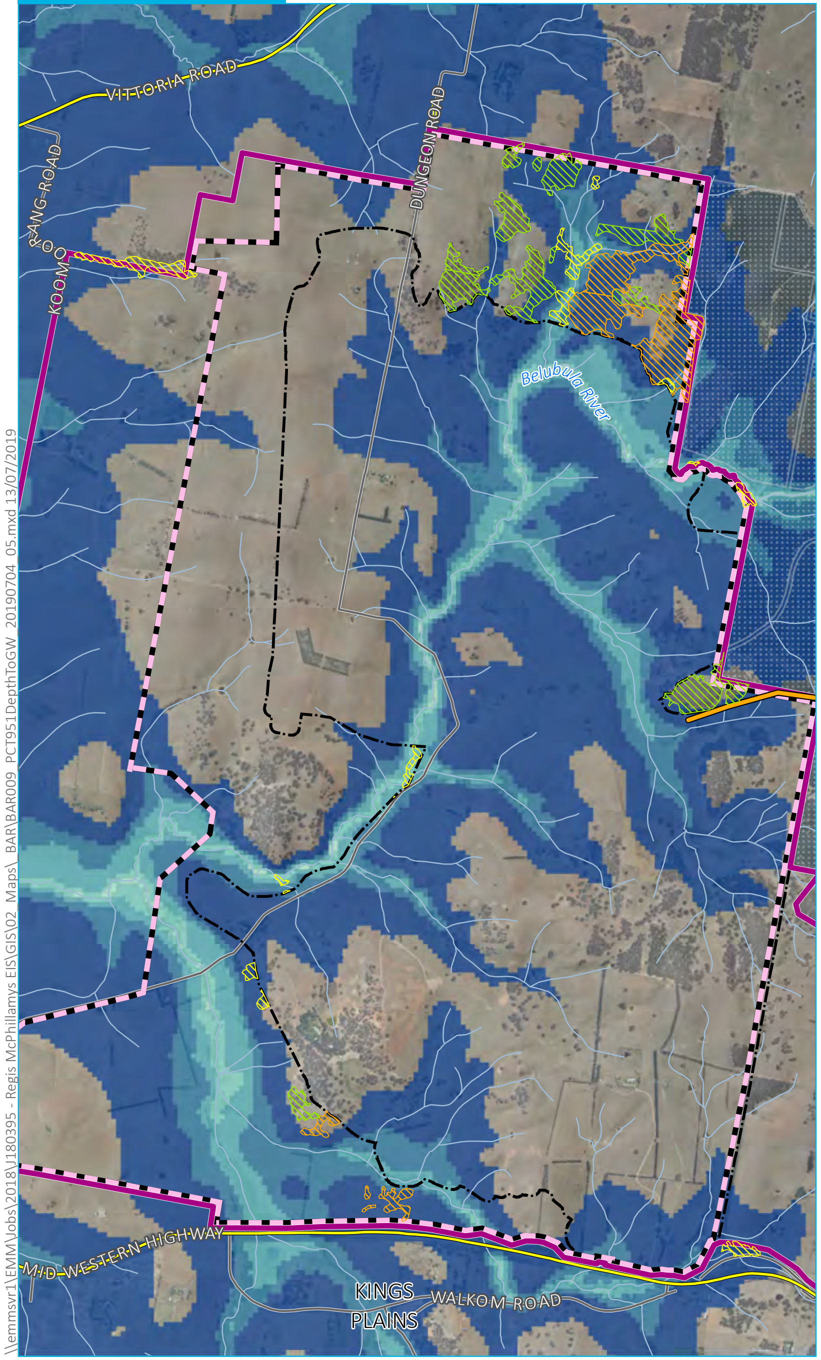
Table 13.7 Changes in access to shallow groundwater in the mine project area

Depth to groundwater (mbgl)	PCT 1330 (ha)			PCT 727 (ha)			PCT 951 (ha)		
	Existing	End of mine	Change	Existing	End of mine	Change	Existing	End of mine	Change
0+ (very high interaction)	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.24	0.22
0 - 0.5 (high interaction)	0.00	0.01	0.01	0.00	0.00	0.00	0.95	1.10	0.15
0.5 - 2 (moderate interaction)	0.11	1.08	0.97	0.00	0.00	0.00	2.03	2.07	0.04
2 - 5 (low interaction)	2.78	4.02	1.24	0.06	0.09	0.04	0.99	0.72	-0.27
5 - 20 (very low interaction)	18.68	17.87	-0.82	10.07	14.19	4.13	3.85	3.45	-0.40

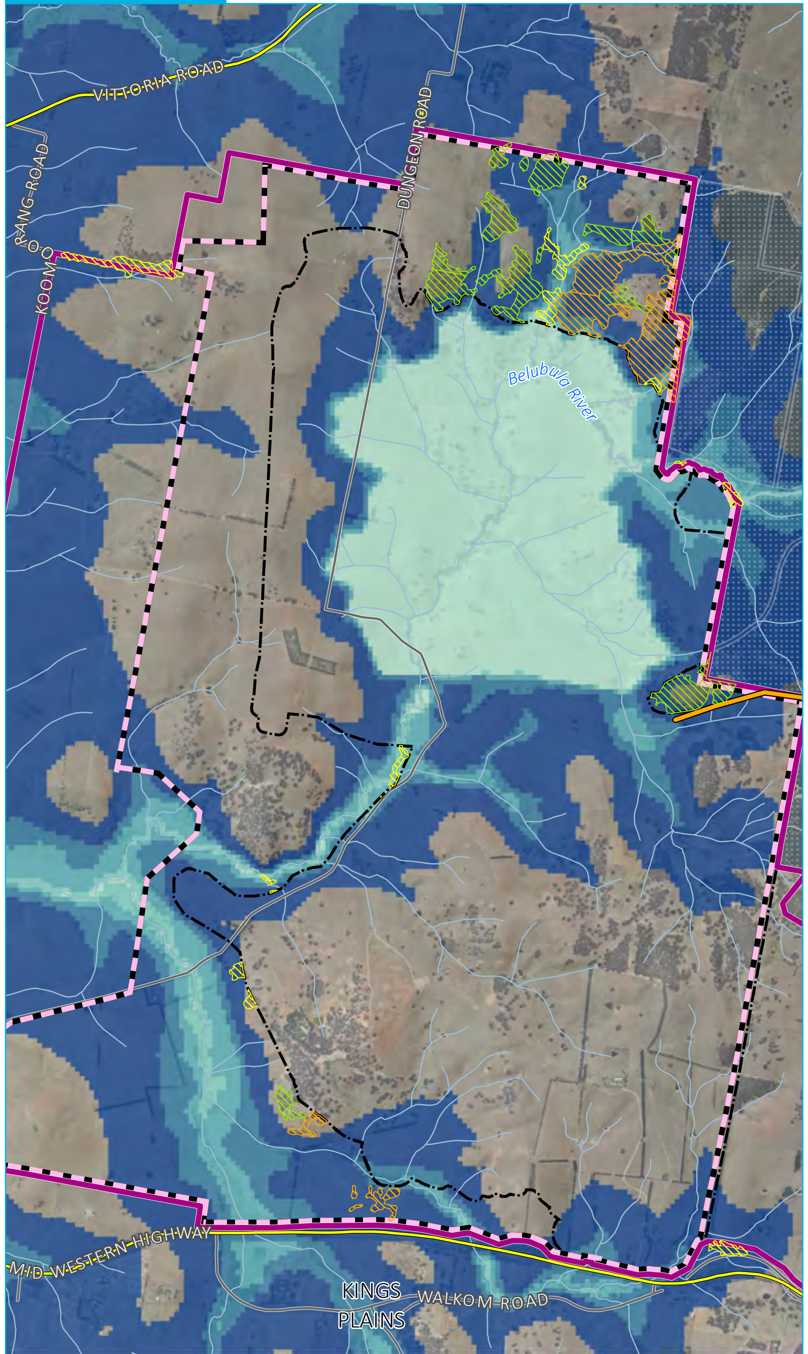
In relation to groundwater quality, the groundwater model simulations and review of the project activities identified the potential for groundwater quality changes as a result of seepage from the TSF, stockpiles and water management facilities.

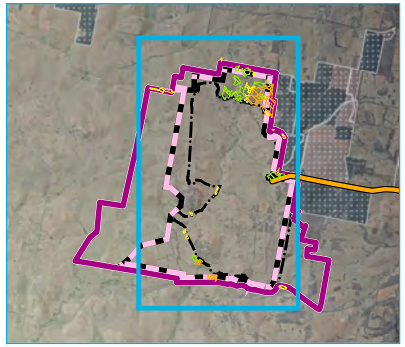
The opportunistic groundwater users (PCT 1330, 727 and 951) are mainly located north of the TSF, with smaller patches to the south and south-west along the Belubula River, and directly south-east of the TSF. The main direction of seepage predicted (without interception measures) is to the south-west and south of the TSF, toward opportunistic groundwater users along the Belubula River, south and south-west of the TSF. However, the quality of groundwater that these patches would access is not expected to change significantly from current baseline conditions due to dilution, but also more importantly due to the robust TSF design and seepage interception measures that have been incorporated into the design. These measures are described in detail in Chapter 2 (project description) and Chapter 9 (water resources).

MODELLED EXISTING CONDITIONS



MODELLED END OF MINING





KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

Existing environment

- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

Depth to groundwater

- 0 m
- 0 - 0.5 m
- 0.5 - 2 m
- 2 - 5 m
- 5 - 20 m

Plant community type (EMM, 2019)

- 1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
- 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
- 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion

Potential impacts on groundwater availability for terrestrial vegetation

Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

0 0.5 1 km
GDA 1994 MGA Zone 55
N

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Figure 13.5

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13.6 Biodiversity credit report

The impacts of the mine development were assessed according to the FBA and BioBanking Credit Calculator. This method allows for impacts on native vegetation and threatened flora and fauna to be quantified, so that a suitable and proportionate offset can be identified, providing for a net positive biodiversity outcome. The method details the offset requirements in terms or ecosystem and species credits.

The areas requiring offsetting are shown in Figure 13.6. Both ecosystem and species credits are required to compensate for the mine development's potential impacts on biodiversity.

The species and ecosystem credits required to offset the residual impact of the mine development are summarised in Table 13.8 and Table 13.9 respectively. In summary, the mine development requires:

- 5,927 ecosystem credits;
- 1,970 species credit for the Koala (*Phascolarctos cinereus)*; and
- 2,845 species credit for the Squirrel Glider (*Petaurus norfolcensis)*.

Table 13.8 Species credits required for the mine development

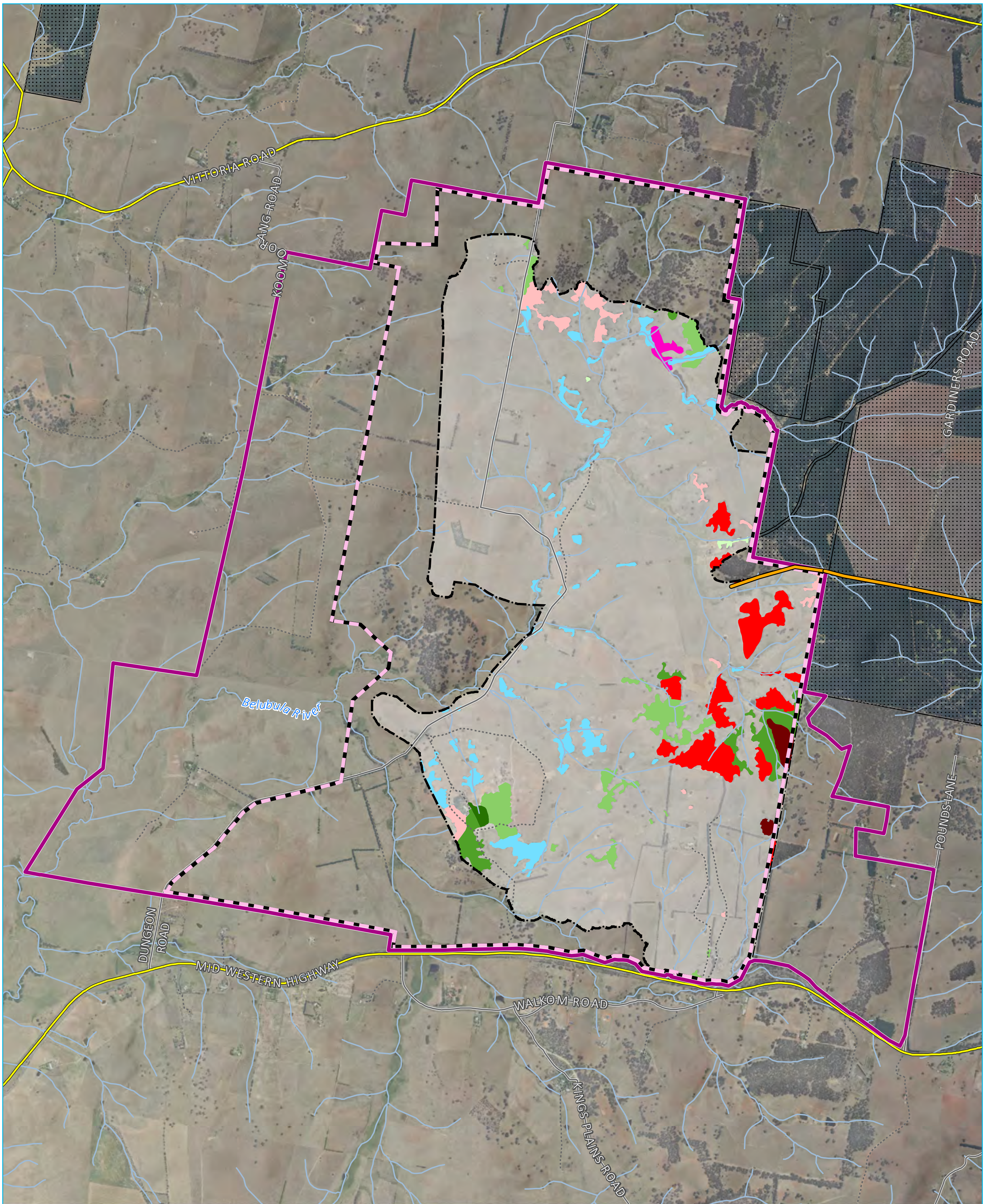
Common name	TS offset multiplier	Credits required
Koala	2.6	1,970
Squirrel Glider	2.2	2,845

Table 13.9 Ecosystem credits required for the mine development

PCT ID and name	Condition	Ancillary	Area (ha)	Credits required
1330 – Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	Mod-Good	High	1.47	0
		Medium	17.03	879
		Other	0.76	31
		Poor	24.96	1,288
727 – Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	Low	High	4.75	257
		Medium	34.55	1,649
		Poor	14.25	589
951 – Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	Mod-Good	Poor	31.55	1,178
785 – Carex sedgeland of the slopes and tablelands (LA130)	Mod-Good	Poor	3.04	56
1330 – Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	Low	-	1,002.38	0
727 – Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	Low	-	1,002.38	0

Table 13.9 Ecosystem credits required for the mine development

PCT ID and name	Condition	Ancillary	Area (ha)	Credits required
951 – Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	Low	-	1,002.38	0
Total			1,134.74	5,927



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); EnviroKey (2017/2018); DFSI (2017); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

N

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest

Vegetation to be cleared (132.35 ha)

727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion

- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)

766 - Carex sedgeland of the slopes and tablelands

- Moderate/Good (Poor)

951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion

- Moderate/Good (Medium)
- Moderate/Good (Poor)

1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

- Moderate/Good (High)
- Moderate/Good (Medium)
- Moderate/Good (Poor)
- Moderate/Good (Other)

Areas of vegetation requiring offset

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Environmental impact statement
Figure 13.6

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13.7 Biodiversity offset strategy

Regis will meet the offset obligation through one, or a combination of, the following actions:

1. establishment of a biodiversity stewardship site, managed under a stewardship agreement; and/or
2. purchase and retire credits available on the biodiversity credit register; and/or
3. payment into the Biodiversity Conservation Trust.

The aim of the offset strategy is to provide no-net loss for the PCTs and threatened species impacted by the project.

The biodiversity credit register was searched on 15 May 2019 to determine if suitable ecosystem and species credits were available. Table 13.10 provides a summary of available credits at the time against the project's ecosystem and species credit requirements.

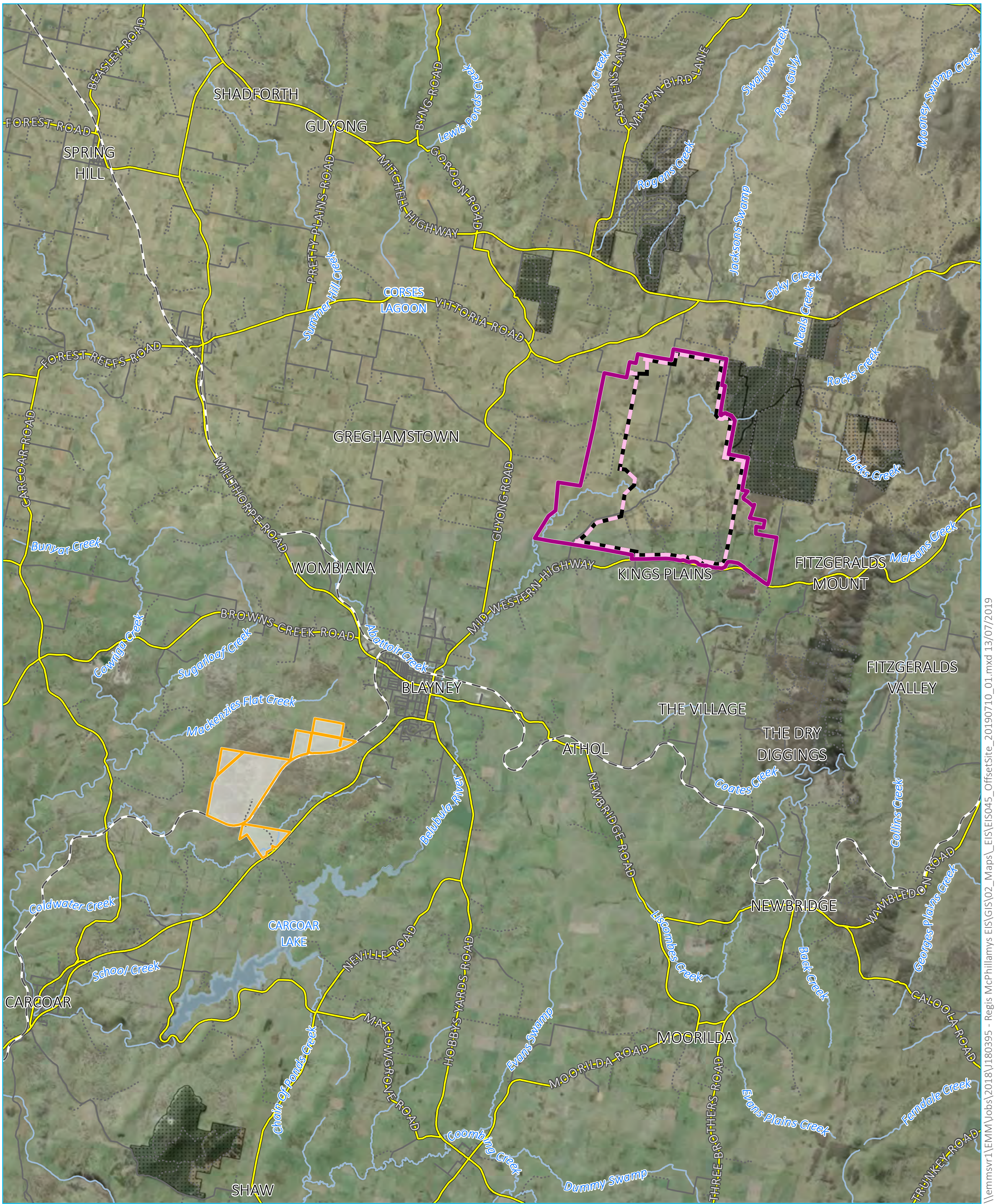
Table 13.10 Assessment of available credits against the mine development's credit requirements

Ecosystem or species credit	Credits available
PCT 727 - Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion (LA124)	0
PCT 785 - Carex sedgeland of the slopes and tablelands (LA130)	0
PCT 951 - Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion (LA164)	1,866
PCT 1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (LA276)	0
Koala	18,018
Squirrel Glider	7,899

As demonstrated in Table 13.10, no ecosystem credits are available for PCT 727, 785 and 1330. Considering this, Regis is currently completing preliminary assessments of a property which it has recently purchased to determine its suitability as a biodiversity stewardship site.

The potential stewardship site is located approximately 3 km south-west of Blayney, as shown in Figure 13.7. One PCT was observed during the site assessment; PCT 277 Blakely's Red Gum Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. The site provides good value as a potential stewardship site, with large areas supporting Box Gum Woodland that meet the condition criteria in the Commonwealth listing advice for the community (PCT condition code high). This site would provide a suitable offset for the project and satisfy the requirements for a direct offset in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC 2012).

If the project's credit requirements cannot be fully met by the establishment of a biodiversity stewardship site and purchasing credits from the biodiversity credit register, Regis intends to meet their remaining credit requirements through payment into the Biodiversity Conservation Fund (BCF). However, credits for significantly impacted species and communities listed under the EPBC Act would only be sourced through purchase of PCTs that represent Box Gum Woodland and appropriate species credits on the biodiversity credit register, or establishment of a stewardship site providing direct like-for-like credits and other compensatory measures, in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC 2012).



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2019); DFSI (2017); ELVIS (2014)

KEY

Existing environment
- Rail line
- Main road
- Local road
- Vehicular track
- Named watercourse
- Named waterbody
- State forest

- Potential stewardship site

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Potential biodiversity stewardship site

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Environmental impact statement
Figure 13.7

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13.8 Matters of National Environmental Significance

This section provides an assessment of the mine development's impacts specific to species and communities listed under the EPBC Act. The identified protected matters in the mine project area are shown in Figure 13.8.

13.8.1 Threatened ecological communities

Recorded PCTs were compared to ecological communities listed under the EPBC Act, namely White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands and Natural Temperate Grasslands of the South Eastern Highlands Bioregion by EMM.

i White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland

Using the criteria in the *EPBC Act Policy Statement 3.5 – White Box Yellow Box Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (DEH 2006), it was determined that PCT 1330 in moderate/good (high) and moderate/good (medium) condition meets the criteria for White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands as listed under the EPBC Act.

Approximately 18.5 ha of the EPBC Act listed community will be impacted by the mine development, while 35.6 ha will be retained within the project area. The Commonwealth listing advice (TSSC 2006) estimates that 250,729 ha of the community is extant in NSW and 416,325 ha on a national scale. Accordingly, the mine development will result in a reduction of 0.007% in the community's NSW extent and 0.004% on a national scale, respectively. The Commonwealth listing advice states that the above estimates are conservative as they include areas in poor condition that do not represent the EPBC Act-listed community.

According to regional PCT mapping (OEH 2018), there is approximately 1,129 ha of PCTs that represent the listed community within a 5 km radius of the mine development. The mine would therefore reduce the extent of critical habitat of this listed community in the locality by approximately 1.68%.

EMM (2019d) determined that the mine development is likely to result in a significant impact (prior to offsetting) on the listed community as 18.5 ha of habitat critical to its survival will be removed. Impacts to the 18.5 ha of the community removed by the mine development are known, predictable and irreversible.

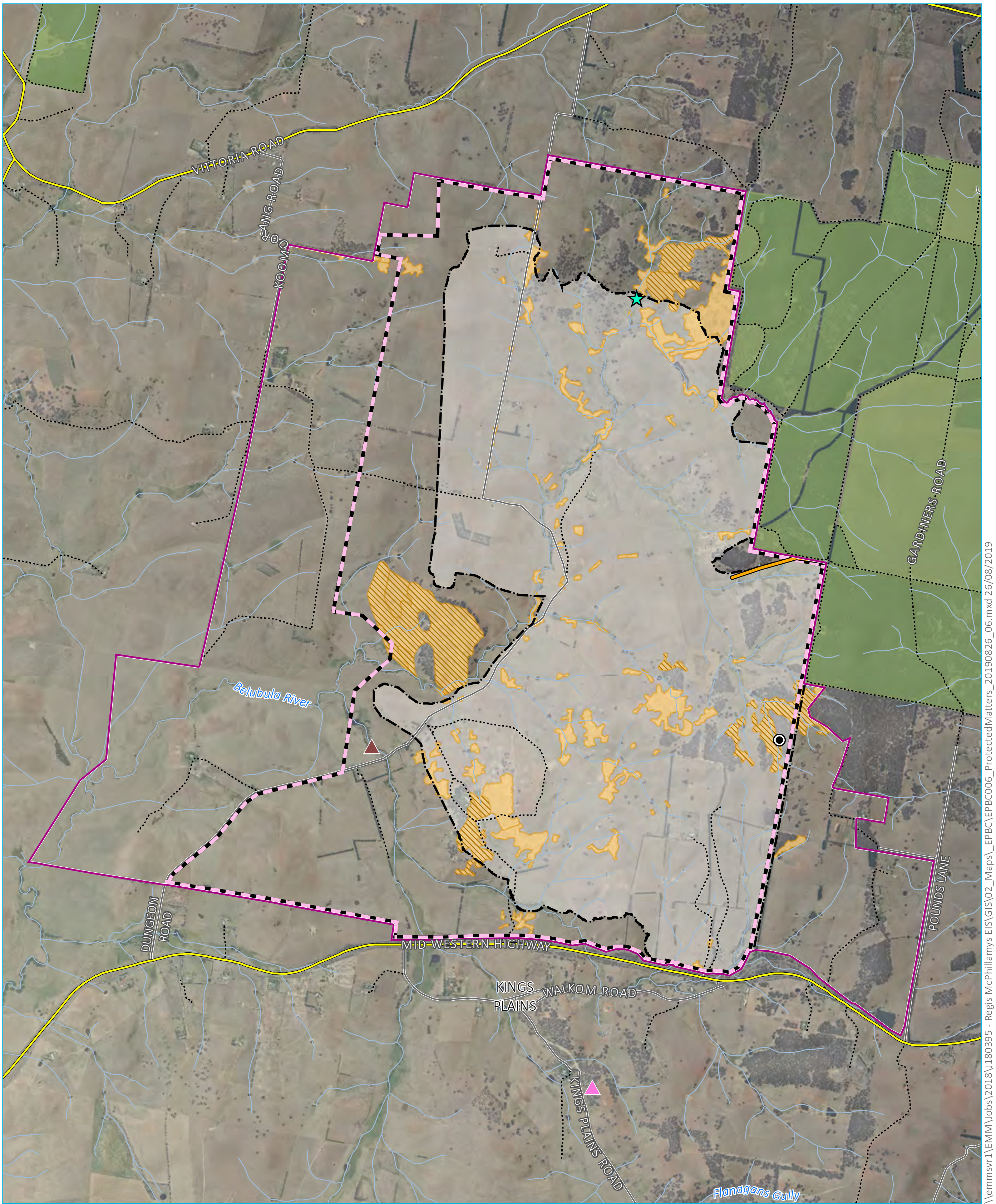
ii Natural Temperate Grasslands of the South Eastern Highlands Bioregion

The Protected Matters Search Tool identified the potential for Natural Temperate Grasslands in the South Eastern Highlands Bioregion to occur in the mine project area.

The biodiversity assessment (EMM 2019d) confirmed that Natural Temperate Grasslands in the South Eastern Highlands Bioregion, listed under the EPBC Act, do not occur in the project area. Although the project area is in the South Eastern Highlands Bioregion and located between 350 – 1200 m above sea level, PCT 766 is dominated by sedges and is a community derived from the prior clearing of trees. This is evidenced by the remnant patches of woodland surrounding these derived communities and the presence of isolated canopy trees.

13.8.2 Threatened species

Two species listed as threatened under the EPBC Act were recorded as being present in the mine project area and/or are considered likely to occur and utilise habitat on-site. These species are discussed further below.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); EnviroKey (2018, 2014, 2013), DFSI (2017); GA (2011)

KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Disturbance footprint

Existing environment

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Vittoria State Forest
- Box Gum Woodland
- Koala foraging habitat

Threatened fauna species (EnviroKey)

November 2013 sightings

- Latham's Snipe
- Superb Parrot

March 2014 sightings

- Rainbow Bee-eater

Threatened fauna species (EMM, 2019)

- Koala (*Phascolarctos cinereus*)

EPBC Act protected matters in project area

McPhillamys Gold Project
Environmental impact statement
Figure 13.8

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i Koala

As noted in Section 13.4.6, a single Koala was recorded in the project area opportunistically. Additionally, PCT 951 is representative of primary Koala feeding habitat and PCT 1330 is representative of secondary Koala feeding habitat. The mine development will result in the clearing of approximately 31.55 ha of primary and 44.22 ha of secondary Koala feeding habitat.

Through application of the *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)* (DoE 2014), it was determined that vegetation in the project area represents habitat critical to the survival of the Koala. EMM (2019d) determined that clearing of this habitat, without offsetting, may significantly impact the Koala as an area of habitat critical to the survival of the Koala would be removed.

The mine development will decrease habitat availability in the mine project area by approximately 75.77 ha. Approximately 148.6 ha of Koala habitat will be retained. In addition, and as mentioned in Section 13.9 (mitigation and management measures), a revegetation program will be undertaken in retained habitat areas to reconnect fragmented patches and increase connectivity for Koala.

Approximately 1,516.3 ha of Koala habitat occurs within a 5km radius of the mine development. This habitat comprises PCTs with key feed tree species in the Central and Southern Tablelands Koala Management Area, in which the mine development occurs, and is a conservative estimate as the composition of key feed species within these PCTs is unknown. Accordingly, the mine development will result in an approximate 5% reduction in Koala habitat within a 5 km radius of the mine.

The species national distribution extends along much of the NSW east coast, extending from Adelaide to the east coast, and northern QLD to the coast (excluding Cape York). The mine development will contribute to a small reduction in Koala habitat on a national scale; however, this will be mitigated by the revegetation program that will aim to reduce the fragmentation of Koala habitat in retained patches of Koala habitat in the mine project area.

ii Superb parrot

The Superb Parrot is listed as Vulnerable under the EPBC Act and was recorded directly south of the mine project area by EnviroKey in 2013.

Breeding habitat of the Superb Parrot consists of River Red Gum (*E. camaldulensis*), Blakely's Red Gum, Apple Box (*E. bridgesiana*), Grey Box (*E. microcarpa*), White Box and Red Box (*E. polyanthemos*). Of these species, Blakely's Red Gum and Apple Box occur in the project area. Despite this, the project area does not occur within the three main breeding areas for the Superb Parrot, so local records of the species are considered to be vagrant (roaming) individuals.

As noted above, PCT 1330 in moderate/good (high) and moderate/good (medium) condition meets the criteria for White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands listed under the EPBC Act. Approximately 18.5 ha of the EPBC Act listed community will be impacted by the mine development. EMM (2019c) determined that the clearance of 18.5 ha of potential Superb Parrot habitat will not result in a significant impact to the species. Vegetation proposed for removal does not represent habitat critical to the survival of the species.

13.8.3 Migratory species

Eleven migratory species listed under the EPBC Act are predicted to occur in the project area based on the results of database searches:

- Curlew Sandpiper *(Calidris ferruginea);*

- Eastern Curlew *Numenius (madagascariensis);*
- Fork-tailed Swift *(Apus pacificus);*
- White-throated Needletail *(Hirundapus caudacutus);*
- Yellow Wagtail *(Motacilla flava);*
- Satin Flycatcher *(Myiagra cyanoleuca);*
- Rufous Fantail *(Rhipidura rufifrons);*
- Common Sandpiper *(Actitis hypoleaucos);*
- Sharp-tailed Sandpiper *(Calidris acuminata);*
- Pectoral Sandpiper; and
- Latham's Snipe *(Gallinago hardwickii).*

All migratory species, except for the Fork-tailed Swift, White-throated Needletail and Latham's Snipe are considered unlikely to occur in the project area. The Fork-tailed Swift and White-throated Needletail do not require further assessment as both species are unlikely to use habitat in the mine project area, despite having a potential presence. Further assessment of Latham's Snipe is provided below.

i Latham's Snipe

Latham's Snipe was recorded directly adjacent to the mine project area by EnviroKey in 2013.

The project area does not meet the definition of important habitat for migratory species in *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DoE 2013) or the definition of important habitat for Latham's Snipe in *EPBC Act Policy Statement 3.21 Industry Guidelines for Avoiding, Assessment Mitigating Impacts on EPBC Listed Migratory Shore Birds* (DoE 2015).

EMM (2019d) determined that the project is unlikely to result in a significant impact on Latham's Snipe as the project area does not contain important habitat for the species or an ecologically significant proportion of the species.

13.9 Mitigation and management

In addition to the avoidance and minimisation measures already incorporated into the mine development's design, as described in Section 13.5.2, the following management and mitigation measures will also be implemented to minimise the potential for unacceptable mine development-related impacts on biodiversity:

- The limit of approved disturbance areas will be identified on the ground via survey to ensure that all ground disturbing activities are only undertaken within approved areas;
- retained areas of the EPBC Act listed community comprising PCT 1330 White Box-Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland will be designated as no-go zones (with the exception of entry for environmental management);
- vegetation will be carefully removed in such a way that avoids damage to surrounding vegetation;

- pre-clearing inspections will be undertaken to identify and, where practicable remove, nesting or roosting fauna;
- specific procedures will be developed and implemented for Koala pre-clearing inspections and safe relocation outside the clearing area;
- revegetation to increase the connectivity of fragmented patches of Koala habitat within the project area will be undertaken throughout the mine life;
- staged clearing of native vegetation and fauna habitat will be undertaken to minimise impacts to native fauna species;
- cleared vegetation will be stockpiled onsite for use during rehabilitation operations, where practicable. Larger vegetation may be retained whole for use in rehabilitation operations on site;
- a weed and pathogen monitoring program will be implemented to ensure impacts to retained vegetation outside the disturbance footprint, but within the project area;
- weed management and pest control programs will be undertaken in consultation with surrounding landholders, based on the results of the weed and pathogen monitoring program; and
- progressive rehabilitation will be undertaken throughout the mine life. The indicative staging of rehabilitation works is illustrated on the staged mine plans provided in Chapter 2.

The above listed measures will be documented and detailed in a biodiversity management plan, to be prepared following project approval.

13.10 Conclusions

The mine project area has experienced a long history of pastural use. As a result, the vegetation in the project area mainly comprises open paddocks with some fragmented patches of timbered natural vegetation scattered throughout.

Biodiversity surveys have been carried out within the project area since 2013. These surveys have been conducted in parallel with, and have informed the evolution of, the development of the mine layout and design. This process has enabled the avoidance of some impacts on Box Gum Woodland and threatened species habitat, as far as practicable.

Notably, through the amendment of the TSF design and relocation of the secondary water management facility, the amount of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC to be cleared has reduced from 33.5 ha associated with the original preferred mine design, to approximately 18.5 ha. Box Gum Woodland (PCT 1330) also provides habitat for the Koala. Accordingly, the reduction in impact on Box Gum Woodland also reduces the impact on Koala habitat.

Following all measures to avoid, minimise and mitigate impacts, the mine development will result in the following residual impacts:

- removal of 132.36 ha of native vegetation and fauna habitat, of which:
  - 129.3 ha comprises habitat for the Squirrel Glider, listed as Vulnerable under the BC Act listed;
  - 75.77 ha comprises habitat for Koala, listed as Vulnerable under the BC Act and EPBC Act;

- 44.22 ha (PCT 1330) represents White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act; and

- 18.5 ha represents White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the Commonwealth EPBC Act.

The area of White Box Yellow Box Blakely's Red Gum Woodland to be cleared by the mine development represents a 3.9% reduction in this vegetation community listed under the BC Act, and a reduction in 1.6% ha of White Box Yellow Box Blakely's Red Gum Woodland CEEC listed under the EPBC Act, within a 5 km buffer of the project area. These impacts will be compensated through the implementation of the project's biodiversity offset strategy.

The mine development requires 5,927 ecosystem credits to compensate for residual impacts on PCTs and their associated threatened species. In addition to ecosystem credits, the mine development also requires 1,970 species credits for the Koala and 2,845 species credits for the Squirrel Glider. Regis will also compensate for these residual impacts through the implementation of a biodiversity offset strategy developed in accordance with the FBA.

Chapter 14

Aquatic ecology

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14 Aquatic ecology

14.1 Introduction

This chapter provides a summary of the aquatic ecology assessment (EMM 2019e), presented in full in Appendix O. The assessment considered the impact of the mine development on environmental receptors such as water and sediment quality, key fish habitat, aquatic biodiversity and native plants which inhabit the riparian zone.

The assessment was carried out in accordance with the EARs. The aquatic ecology related EARs and where they are addressed are presented in Table 14.1.

Table 14.1 Aquatic ecology related EARs for the mine development

Requirement	Where addressed
An assessment of the likely impacts of the development on aquatic ecology and key fisheries issues, including aquatic biodiversity and key fish habitats.	This chapter and Appendix O
A detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development.	This chapter and Appendix O for aquatic ecology. Terrestrial biodiversity is addressed in Chapter 13.

The aquatic assessment was also prepared in accordance with the following guidelines:

- *Policy and guidelines for fish habitat conservation and management* (DPI 2013b);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1 The Guidelines Chapter 1 to 7* (ANZECC & ARMCANZ 2000); and
- *NSW Biodiversity Offsets Policy for Major Projects Fact Sheet: Aquatic Biodiversity* (DPI 2014b).

14.2 Existing environment

A description of the existing catchment and flow of the upper Belubula River and its tributaries is contained in Section 9.2.2 above.

The riparian zone surrounding the Belubula River is highly fragmented, with native vegetation occurring only in isolated patches and surrounded by agricultural land. Aquatic and riparian habitat is generally of poor condition, with invasive exotic species dominant and habitat modification prevalent (e.g. constructed dams, land clearing, surface flow barriers).

14.3 Methods

14.3.1 Desktop review

i Database searches

Database searches were undertaken to compile background information and to determine the likelihood of occurrence of conservation significance species that may occur in the waterway or riparian zone of the Belubula River and associated tributaries.

ii Literature review

A literature review of publicly available information relating to the aquatic and riparian environment, within and adjacent to the mine development as well as previous assessments carried out for the McPhillamys project was carried out to further determine the likelihood of occurrence of conservation significance species that may occur in the waterway or riparian zone of the Belubula River and associated tributaries.

14.3.2 Field survey

As part of the aquatic ecology assessment, EMM conducted a field survey from 20 to 22 November 2018. The field survey was conducted on foot during dry conditions, however heavy rains were experienced on the third field day.

Sites were assessed for key fish habitat and riparian vegetation condition. At each site, a water way type and class assessment and habitat characterisation were also completed.

The field survey was undertaken within, and downstream of, the mine development, and includes the junctions of the Belubula River and the Mid Western Highway, and the Belubula River and Newbridge Road. A total of 15 sites within the Belubula River and associated tributaries, and their associated riparian zones, were assessed for key fish habitat and riparian vegetation condition (refer Figure 14.1). Each waterway assessed had previously been ranked according to the Strahler method of stream ordering. It should be noted that Tributary F and Tributary G were not assessed as part of the field survey due to the presence of pastoral dams.

i Key fish habitat

Key fish habitat was assessed in accordance with *Policy and Guidelines for fish habitat conservation and management* (DPI 2013b). Habitat sensitivity was assessed at each site by assigning a 'waterway type', while the functionality of the waterway as fish passage was assessed by assigning a 'waterway class'.

The three waterway types are summarised in Table 14.2, while waterway class definitions are summarised in Table 14.3.

Table 14.2 Waterway type definitions for habitat sensitivity

Classification	Characteristics of waterway type
Type 1 – Highly sensitive key fish habitat	Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants.
Type 2 – Moderately sensitive key fish habitat	Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in Type 1.
Type 3 – Minimally sensitive key fish habitat	Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation.

Table 14.3 Waterway class definitions for fish passage

Classification	Characteristics of waterway class
Class 1 – Major key fish habitat	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.

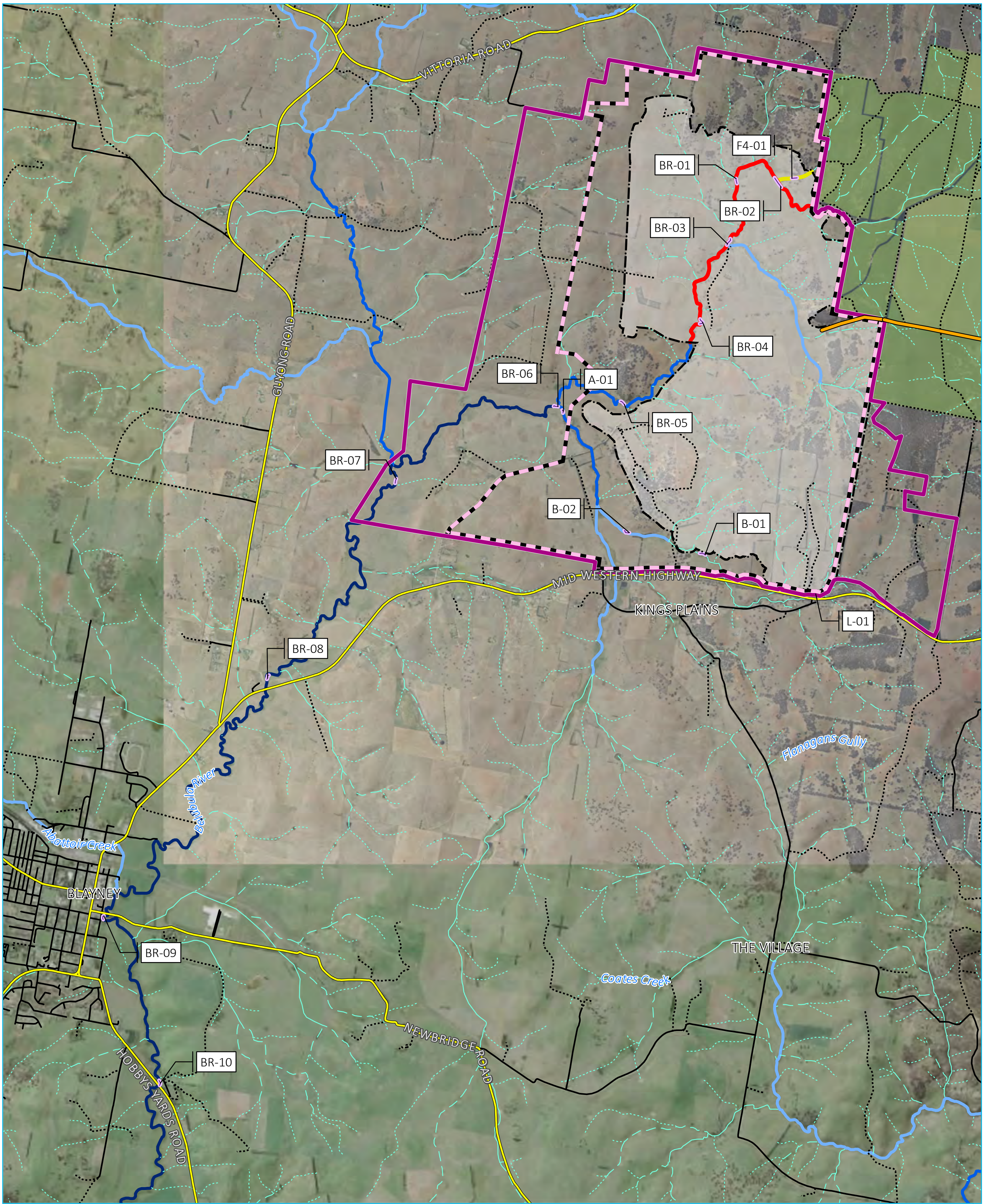
Table 14.3 Waterway class definitions for fish passage

Classification	Characteristics of waterway class
Class 2 – Moderate key fish habitat	Generally named intermittently flowing stream, creek or waterway with clearly defined bed and banks, semi-permanent to permanent water in pools or in connected wetland areas. Freshwater aquatic vegetation is present. Type 1 and Type 2 habitats present.
Class 3 – Minimal key fish habitat	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other Class 1-3 fish habitats.
Class 4 – Unlikely key fish habitat	Generally unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools post-rain events (e.g. dry gullies, shallow floodplain depressions with no aquatic flora).

ii Riparian vegetation

At each survey site, notes were made on the following components regarding riparian zone condition:

- habitat continuity and extent;
- vegetation cover and structural complexity;
- dominance of natives versus exotics;
- standing dead trees, hollows, fallen logs and leaf litter; and
- other indicative features.



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Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014); DPI (2013)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Aquatic ecology assessment site

Waterway type classification
- Type 1
- Type 3

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Disturbance footprint

Pipeline corridor

Existing environment
- Main road
- Local road
- Vehicular track
- Vittoria State Forest

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

Field survey locations and waterway type classification within disturbance footprint

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Environmental impact statement
Figure 14.1

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14.4 Results

14.4.1 Desktop review

i Database searches

The database searches did not identify any endangered ecological community associated with the Belubula River upstream of Carcoar Dam. A total of five fish species were identified in the database searches as having the potential to occur within or downstream of the mine development and were listed as either vulnerable or endangered under the FM Act or EPBC Act due to their historic occurrence within the Lachlan, Murrumbidgee, Macquarie, Darling and Murray rivers of the Murray-Darling Basin, as well as associated tributaries. However, the larger pelagic species (Trout Cod, Murray Cod, Macquarie Perch) are unlikely to occur within waterways of the project area due to the level of disturbance and a lack of connectively in the vicinity of the mine development. DPI Fisheries-provided threatened species distribution mapping shows that the Eel-tailed Catfish and the Southern Purple-spotted Gudgeon are currently largely absent from the waterways adjacent to the project area.

ii Previous investigations

Envirokey (2013) carried out a baseline characterisation of aquatic ecological condition of the Belubula River and associated tributaries. During this assessment comprehensive platypus and habitat assessment were also completed. The baseline assessment found the riparian zone to be moderately to highly disturbed, with grazing present at all sites assessed contributing to a poor bank condition, degradation of the instream vegetation and sedimentation. No platypus sightings were recorded with the vast majority of aquatic habitats not supporting potential habitat due to degraded habitat and no connectivity between different sections of the river and the wider tributary river systems (EnvrioKey 2013).

EMM carried out a spring and aquatic survey in 2018 (EMM 2018b). This survey were carried out to assess the influence from unseasonably dry (drought) conditions experienced in the region. The sites previously surveyed by EnviroKey (2013) were revisited and additional sites were surveyed for aquatic habitat including platypus habitat and condition. The results of this survey confirmed Envirokey’s findings regarding the very poor condition of riparian vegetation and absence of platypus habitat within the project area.

14.4.2 Survey results

i Key fish habitat

Results from the key fish habitat waterway assessments undertaken at 15 sites during the November 2018 field survey are summarised below and presented in Table 14.4. Photographs from the field assessment are presented in Plates 14.1 to

Table 14.4 Summary of stream order, waterway type and waterway class at sites along the Belubula River and associated tributaries

Site	Stream order	Key fish habitat waterway type	Key fish habitat waterway class
A-01	5th	Type 1 - Highly sensitive key fish habitat	Class 2 - Moderate key fish habitat
B-01	3rd	Type 1 - Highly sensitive key fish habitat	Class 3 - Minimal key fish habitat
B-02	4th	Type 1 - Highly sensitive key fish habitat	Class 3 - Minimal key fish habitat
BR-01	4th	Type 1 - Highly sensitive key fish habitat	Class 3 - Minimal key fish habitat
BR-02	3rd	Type 1 - Highly sensitive key fish habitat	Class 3 - Minimal key fish habitat
BR-03	4th	Type 1 - Highly sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-04	5th	Type 1 - Highly sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-05	5th	Type 1 - Highly sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-06	6th	Type 2 - Moderately sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-07	6th	Type 2 - Moderately sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-08	6th	Type 1 - Highly sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-09	6th	Type 2 - Moderately sensitive key fish habitat	Class 2 - Moderate key fish habitat
BR-10	6th	Type 2 - Moderately sensitive key fish habitat	Class 2 - Moderate key fish habitat
F4-01	2nd	Type 3 - Minimally sensitive key fish habitat	Class 4 - Unlikely key fish habitat
L-01	3rd	Type 1 - Highly sensitive key fish habitat	Class 4 - Unlikely key fish habitat

The assessment considered while the potential exists for aquatic vegetation, in-channel debris and vegetation to provide appropriate key fish habitat at sites surveyed as Type 1 or 2 Class 2 Moderate key fish habitat, it unlikely that sites with the exception of BR-03 would support species of conservation significance due to a number of factors observed in the field, comprising:

- dams that would likely impede surface flow and therefore fish passage;
- degraded riparian zones, and erosion of channel banks and substrate;
- an abundance of weeds and other exotic vegetation on the fringe of the channels;
- sediment alluviation and silty substrates which may increase turbidity and sedimentation during flow events;
- impacts from livestock and grazing; and
- proximity of the majority of the waterways to agricultural zones, with a number of sites potentially affected by major roads, rubbish and residential inflows.

While 10 sites were classified as Type 1 or 2 Class 2 Moderate key fish habitat in accordance with the classifications defined in *Policy and Guidelines for fish habitat conservation and management* (DPI 2013b), only one of these sites: BR-03, within the Belubula River (refer Figure 14.1), was considered to have a moderate likelihood of supporting species of conservation significance. This ranking was attributed to the presence of a large pool with a muddy loam substrate, linked by shallow riffle sections within a broad channel and presence of aquatic vegetation.

ii Riparian vegetation

The riparian condition of all sites was considered poor, with riparian zones generally degraded and impacted to some degree by agricultural uses. Little to no native vegetation was observed at majority of the sites, which consisted of mostly introduced willow species. Native eucalyptus species were observed at some sites like A-01 and BR-06, however this was comprised of very sparse open woodlands to individual trees. The understorey at the majority of sites was characterised by exotic grasses and weeds along the bank and within the waterway channel. Blackberry (*Rubeus fruticosus*), a weed of national significance, was observed at three sites.

Habitat continuity was observed at BR-03 which may provide habitat for fish species. This consists of vegetation cover, stream logs and other debris.

14.5 Impact assessment

14.5.1 Direct and indirect impacts

The aquatic ecology assessment considered the impact of the mine development on such environmental receptors as water and sediment quality, key fish habitat, aquatic biodiversity and native plants which inhabit the riparian zone.

The mine development is unlikely to pose a significant aquatic ecological risk, due to the lack of species of conservation significance supporting habitat. Despite this, the mine development could directly or indirectly impact on aquatic ecology and key fish habitat as follows:

- direct impacts:
  - decrease in short-term water and sediment quality;
  - removal and fragmentation of aquatic and riparian habitat by the development of the TSF; and
  - reduction / cessation in surface water flow between the headwater of the Belubula River and Trib A.
- indirect impacts:
  - decrease in medium term water and sediment quality;
  - breach of water quality objectives as a result of seepage to groundwater, unplanned discharge to surface water, runoff, or failure of the surface water management system;
  - potential for reduction in surface water flow;
  - altered hydrology within the Belubula River during high-flow events;
  - erosion, siltation and degradation of the riparian zone, including an increase in instability of waterway banks and beds;
  - reduced recruitment of native riparian plants, including potential loss of conservation significant vegetation and habitat; and
  - contribution to key threatening processes.

14.5.2 Key fish habitat

Notwithstanding the existing degradation and lack of connectivity of the existing aquatic environment within the mine project area, the assessment classified the sites assessed within the Belubula River and Trib A during the field survey as Type 1 highly sensitive key fish habitat. This was due to the presence of habitat features such as instream aquatic vegetation and in-channel debris. The mine development will accordingly result in the direct impact of removal of areas of key fish habitat along approximately 1.8 km of Type 1-highly sensitive key fish habitat and approximately 0.4 km of Type 3-minimally sensitive key fish habitat within the disturbance footprint (as shown in Figure 14.1).

14.5.3 Riparian vegetation

Limited degraded riparian vegetation will be removed along the Belubula River and associated tributaries within the disturbance footprint. Erosion and further degradation of riparian zones may occur over the short to medium term, which could lead to instability of waterways and increased sedimentation. This is unlikely to impact conservation significant riparian vegetation and habitat due to its absence in the mine project area, including threatened species or communities listed under the EPBC Act or Ramsar wetlands of international importance. Impacts to riparian vegetation due to mine development is anticipated to be minor and local to the project area.

Progressive rehabilitation will be carried out as part of the project. Riparian restoration and improvement works on the Belubula River downstream of the disturbance footprint as well as along Trib A will offset the loss of riparian vegetation due to the construction and operation of the mine development.

14.5.4 Threatened species and populations

Considering the existing environmental degradation and lack of on-going mitigation or management for aquatic ecology across the region, it is unlikely that species of conservation significance exist in the mine project area. EMM (2019e) has therefore determined that the mine development is unlikely to significantly impact aquatic threatened species, populations or ecological communities listed under the FM Act and EPBC Act.

Only one site on the Belubula River (BR-03) was considered during the field survey to have a moderate likelihood of supporting species of conservation significance. This ranking was attributed to the presence of a large pool with a muddy loam substrate, linked by shallow riffle sections within a broad channel and presence of aquatic vegetation. However, it is considered unlikely that the upper Belubula River system provides sufficient connectivity during low flow conditions. This, in conjunction with the overall highly disturbed condition of the aquatic environment in the mine project area, indicate that BR-03 is unlikely to support threatened species. This site will be removed due to construction of the TSF.

14.5.5 Surface waterflow and water quality

i Waterflow impacts on aquatic ecology

The natural flow regime of the Belubula River and tributaries is highly disturbed. The catchments have been extensively cleared for agriculture, and on-stream farm storage dams have been constructed along the length of the streams, impeding the natural flow.

As discussed in Chapter 9, the mine development has the potential to impact on the flow regime of local streams due to:

- reduction in catchment area and runoff associated with the operational water management system for the project; and

- interception of natural baseflow to streams associated with depressurisation of groundwater systems during mining and post-mining.

The predicted median annual inflows to Carcoar Dam during the operational phase of the project are predicted to be reduced by 242 ML/yr (4.1%) when compared to the existing situation. During the post-closure phase, following rehabilitation, median annual inflows would be reduced by 28 ML/yr (0.47%) when compared to the existing situation (HEC 2019). This level of change in streamflow is expected to be minor in comparison with the natural variability in catchment conditions and accordingly is not expected to have a measurable impact on aquatic habitats downstream from the project area.

ii Water quality impacts on aquatic ecology

Without mitigation, evidence of seepage from the TSF could be observed as expression of seepage at the ground surface directly downstream from the embankment, and some seepage springs could appear in depressions/hollows or discharge to the Belubula River downstream of the embankment.

However, the results of the groundwater assessment (refer Appendix K) indicate that even without all seepage management measures in place, any seepage that may migrate through the hydrostatic unit (HSU) and discharge to the Belubula River will have concentrations below the observed baseline surface water quality concentrations, ANZECC (2000) livestock drinking water and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values. Therefore, no water quality impacts on downstream aquatic environments arising from seepage from the TSF are predicted.

14.5.6 Management measures

The following measures relevant to aquatic ecology will be implemented to provide guidance on future research, monitoring and environmental management:

- ongoing monitoring and assessment of mine development impacts on aquatic and riparian ecology will be undertaken, as detailed in the biodiversity management plan;
- implementation of appropriate aquatic rehabilitation programs outside the disturbance footprint along waterway banks and within the riparian zone, as documented in the biodiversity management plan;
- where possible existing dams, weirs or other in-stream structures, not critical to mine development function, will be removed to increase the potential for movement of aquatic fauna; and
- engage with stakeholders to promote catchment improvement programs for the Belubula River above Carcoar Dam.

In addition, an aquatic ecology offset strategy will be prepared and implemented in consultation with DPI Fisheries and in accordance with *Biodiversity Offsets Policy for Major Projects Fact Sheet: Aquatic Biodiversity* (DPI 2014).

14.6 Conclusions

The aquatic ecology assessment of the mine development assessed 15 sites across the upper Belubula River and associated tributaries. Twelve of these sites are located in the mine project area and three outside of the project area, at the junctions of the Belubula River and the Mid Western Highway, Newbridge Road and Hobby Yards Road.

The assessment found aquatic habitat in the mine project area is unlikely to support threatened species habitat, including habitat to support breeding or migration, due to the low level of connectivity between pools and the highly disturbed condition of the aquatic environment.

Notwithstanding, this existing degradation of the aquatic and riparian environments, the majority of surveyed sites within the mine project area were still classified as Type 1 highly sensitive key fish habitat due to the presence of aquatic habitat features such as instream aquatic vegetation and in channel debris. The mine development will result in the direct impact of removal of areas of key fish habitat along approximately 1.8 km of Type 1-highly sensitive key fish habitat and approximately 0.4 km of Type 3-minimally sensitive key fish habitat within the disturbance footprint.

An aquatic ecology offset strategy will be prepared and implemented to offset the loss of key fish habitat in the mine disturbance footprint with consideration to with the *Biodiversity Offsets Policy for Major Projects Fact Sheet: Aquatic Biodiversity* (DPI 2014) and in consultation with DPI Fisheries.

Chapter 15

Aboriginal heritage

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15 Aboriginal heritage

15.1 Introduction

An Aboriginal and historical cultural heritage assessment (AHCHA) was prepared for the mine development by Landskape (2019), which is provided in full in Appendix P.

This chapter provides a summary of the AHCHA as it relates to Aboriginal cultural heritage. Historic heritage is discussed in Chapter 16. This chapter discusses the historical context in and surrounding the mine project area, describes the consultation undertaken with the Aboriginal community, outlines fieldwork methods and items identified in the project area, and assesses the potential impacts of the mine development on Aboriginal cultural heritage values and where impacts are unavoidable, the measures proposed to mitigate impacts.

15.2 Assessment requirements and methods

The EARs require an assessment of the mine development's potential impact on Aboriginal heritage. The specific requirements and sections of the EIS that address them are provided in Table 15.1.

Table 15.1 Aboriginal heritage related EARs for the mine development

Requirement	Where addressed
Heritage – including	
– an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with *Aboriginal stakeholders having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH 2011); and	This chapter addresses Aboriginal cultural heritage. Historical heritage is addressed in Chapter 16 and Appendix P.
– an assessment of the impact on environmental heritage in accordance with the NSW *Heritage Manual*, including heritage conservation areas and State and local heritage items within and near the site, and detailed mitigation measures to offset potential impacts on heritage values.	

The AHCHA was guided by the following documents to fulfil the requirements of the EARs:

- *Guide to Investigation, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (DECCW 2011b);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a);
- *Aboriginal Cultural Heritage Community Consultation Requirements for Proponents 2010* (DECCW 2010d); and
- *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (DEC 2005).

The AHCHA prepared by Landskape (2019) for the mine development takes into consideration the findings of a preliminary Aboriginal cultural heritage assessment (ACHA) completed by Navin Officer in 2017/2018 during the early stages of planning for the mine.

The key findings presented in this chapter relating to potential impacts on Aboriginal cultural heritage as a result of the mine development are based on Landskape AHCHA (2019), which includes the significance assessment in Section 15.7, impact assessment in Section 15.8 and management measures in Section 15.9. A discussion on the early findings of the Navin Officer ACHA (2017) is provided in Section 15.3.2.

15.3 Existing environment

15.3.1 Landscape overview

The mine project area consists of rounded bedrock hills with a maximum elevation of around 1018 m AHD, ranging from 872 m AHD to 1018 m AHD. Loamy soil is mostly present from weathering of the Anson Formation. Alluvial terraces of the Belubula River in the west of the project area consist of overbank deposits of clay and silt. Relevantly to cultural heritage, land within the project area has been extensively modified by agricultural land uses including cropping and grazing, historical mining activities and construction of roads and utilities.

Searches of the Aboriginal Heritage Information Management System (AHIMS) register identified one previously recorded site in the project area; AHIMS #44-2-0122 (numbered KP-OS-02 in the AHCHA), which is an artefact scatter (refer to Figure 15.1).

15.3.2 Previous investigations

i Navin Officer (2017)

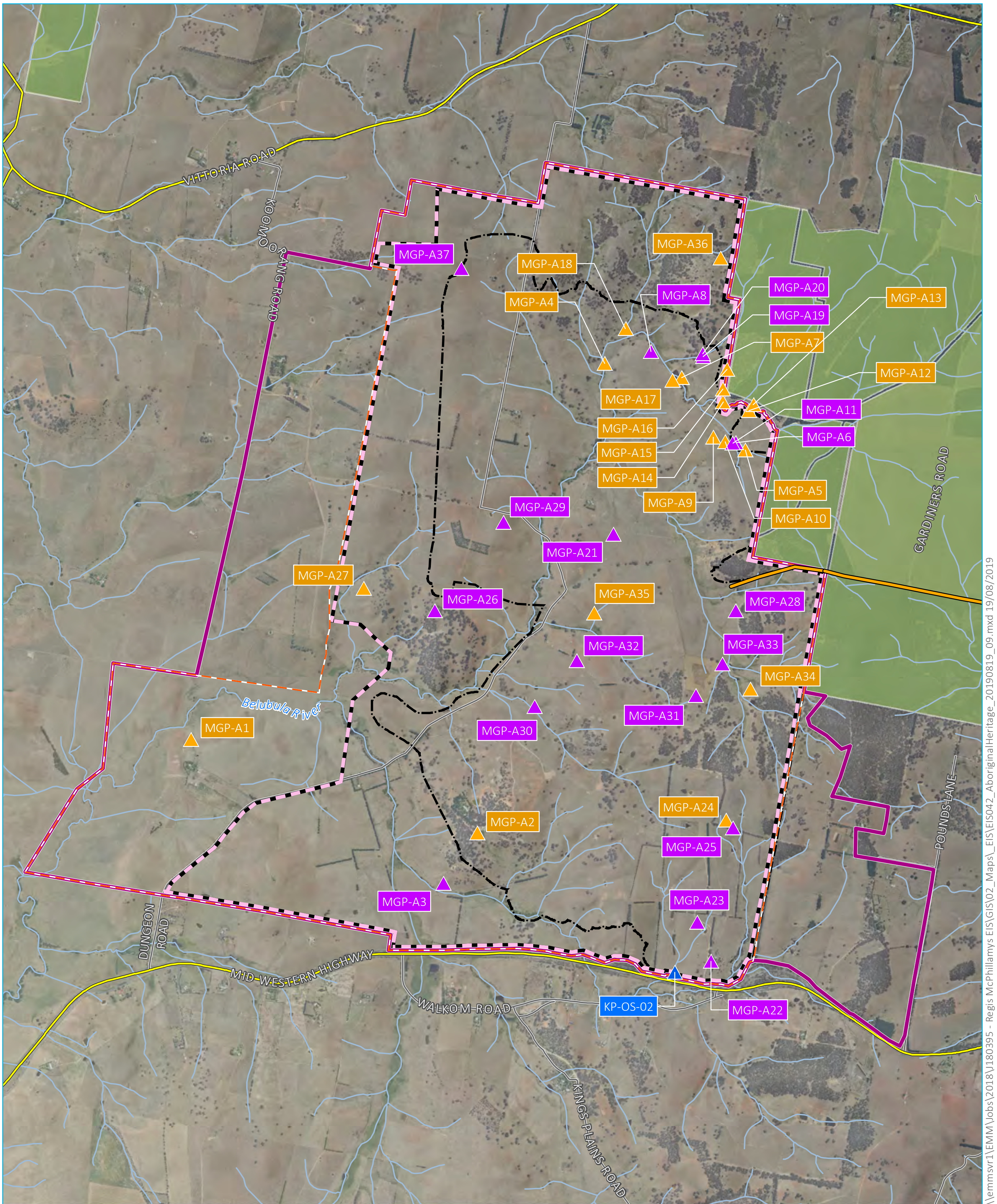
As noted in Section 15.2, Navin Officer prepared an ACHA in 2017/2018 during the early stages of planning for the mine development. The mine design for which approval is now sought was not finalised at this stage; however, the ACHA provided an initial view on the Aboriginal sites within the project area. As part of that ACHA, Navin Officer undertook a desktop review of the project area, consultation with registered Aboriginal parties (RAPs) and a field survey between 18 April 2017 and 11 May 2017. The surveys were attended by representatives from Navin Officer and the Orange Local Aboriginal Land Council (OLALC).

The ACHA (Navin Officer 2017) was also subject to two peer reviews:

- Landskape (2017); and
- Stone (2018).

A description of the consultation and field surveys undertaken by Navin Officer is provided in Section 15.4 and 15.5, respectively. The Stage 1 consultation and field surveys undertaken by Navin Officer fulfilled the requirements of the *Aboriginal Cultural Heritage Community Consultation Requirements for Proponents* (DECCW 2010d). The results from the Navin Officer survey were used by Landskape to inform their assessment.

Navin Officer (2017) identified 54 unregistered Aboriginal sites in the project area, which are summarised in Table 15.2.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); Landskape (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

- Study area

Aboriginal heritage site (Landskape, 2019)
- Artefact scatter (19)
- Isolated find (18)

Previously recorded site
- Open artefact site (1)

Aboriginal cultural heritage sites in the mine project area

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Figure 15.1

Table 15.2 Artefact type and frequency in the mine project area (Navin Officer 2017)

Artefact type	Site frequency
Artefact scatter	18
Isolated find	18*
Scarred tree	10**
PAD	8

*17 were identified by Navin Officer during their field survey, and one by the OLALC during previous site visits.

**Two scar trees were identified by Navin Officer in their field surveys. A further eight were identified by the OLALC on previous visits.

a Landskape (2017) and Stone (2018)

Landskape (2017) was engaged to undertake a peer review of the Navin Officer ACHA (2017). This review primarily focussed on the potential archaeological deposits (PADs) identified by Navin Officer. Landskape formed the view that Navin Officer (2017) markedly underestimated the level of previous disturbance that has occurred at each of the potential archaeological deposits.

> All are described as having "low", "mostly low" or "relatively low" levels of disturbance. Except for the eastern part of MGP-PAD5, all the areas have been previously cleared for pastoral and agricultural land use. This has involved clearfelling all of the original trees and minor to major land surface levelling. Almost 200 years of livestock grazing and vehicular traffic has exacerbated sheet erosion, particularly at MGP-PAD4 - MGP-PAD8. MGP-PAD4 has been modified by earthworks and has extensive gullying. These processes have definitely disturbed the topsoil over the entire areas of the potential archaeological deposits and disrupted the subsoil of parts of them. This reduces the potential for stratigraphically intact artefact assemblages, diminishing their scientific significance.

A second peer review was commissioned, completed by Tim Stone (2018). Stone's (2018) peer review provided an assessment on the likelihood and significance of sites identified by Navin Officer (2017) during field surveys, again primarily focusing on the PADs. Like Landskape (2017), Stone (2018) notes that archaeological material is likely to be present on the land surface or shallow subsurface, no deeper than 10 centimetres (cm) in the A2 soil horizon.

Stone (2018) describes the majority of the PADs identified (MGP-PAD1, MGP-PAD2 and MGP-PAD4 to MGP-PAD8) to be inconsistent with the definition of a PAD in *Code of Practice for Archaeological Investigation of Aboriginal objects in NSW* (DECCW 2010a) and therefore unlikely to be a PAD. However, Stone (2018) notes that there is low potential for these sites to contain subsurface archaeological material. Stone (2018) describes MGP-A1 (artefact scatter and PAD) and MGP-A3 (isolated find and PAD) to be smaller in area than identified by Navin Officer (2017), which are likely to be small transient campsites.

The two scarred trees (MGP-ST-NR 1 and NR 2), identified by Navin Officer as being of possible Aboriginal origin (MGP-ST-NR 1) and unlikely Aboriginal origin (MGP-ST-NR 2), were considered by Stone (2018) to be natural tears in the tissue of the tree with no archaeological significance.

Based on the outcome of these two reviews, Landskape's assessment (2019) in relation to PADs concluded that:

> The shallow soils of the project area, coupled with past disturbance from mining, pastoralism, agriculture, and dam, track and fence construction, means that significant in situ subsurface cultural deposits are highly improbable. The project area does not contain culturally sensitive landforms such as lunettes or source-bordering sand dunes where subsurface Aboriginal cultural deposits (e.g. burials) have been recorded previously. Archaeologists from Navin Officer Heritage Consultants thought that a number of areas in the project area had potential for subsurface archaeological deposits.

However, a detailed critique by geoarchaeologist Dr Tim Stone (pers. comm. 2018) discounted the likelihood that all of these areas in the disturbance footprint were differentiated from the surrounding archaeological landscape.

15.4 Aboriginal consultation

15.4.1 Stage 1 – notification and registration of Aboriginal parties

The following consultative process was completed by Navin Officer consistent with Stage 1 of the *Aboriginal Cultural Heritage Community Consultation Requirements for Proponents* (DECCW 2010d):

- notification letters were sent to the OLALC, Blayney Shire Council, Central Tablelands and Local Land Services; NSW OEH, Native Title Services Corporation Ltd and Office of the Registrar of NSW *Aboriginal Land Rights Act 1983* on 16 November 2016 requesting identification of local RAPs;

- advertisement was placed in the Central Western Daily and Blayney Chronicle on 17 November 2016 inviting interested persons/parties register their interest in the project;

- notification letters were sent to identified RAPs on 17 November 2016; and

- search of the National Native Title Tribunal registers on 22 November 2016.

Only the OLALC registered their interest in the project.

15.4.2 Stages 2 and 3 – presentation of information and gathering cultural information

A request for feedback on the proposed field survey methodology and information on cultural heritage of the project area was sent to the OLALC by Navin Officer on 7 March 2017, to which no response was received.

15.4.3 Stage 4 – review of draft Aboriginal Cultural Heritage Assessment

A draft copy of the AHCHA was provided to the OLALC on 3 June 2019 for review and feedback. It was also provided to Nyree Reynolds on 27 May 2019, who whilst not a RAP, requested a copy from Regis. A response from the OALC was received on 3 June 2019, which included a number of recommendations relating to the assessment. These recommendations, and the response from Landskape is summarised in Section 3.2.4 of the AHCHA (refer to Appendix P).

15.5 Field survey methods

15.5.1 Predictive model of Aboriginal site location

A predictive model of Aboriginal site location was developed by Landskape (2019) and considered the environmental and archaeological context of the project area. This included a review of past surveys completed in the region. Past surveys indicate that artefact scatters and scar trees are commonly found in Central Western NSW. Landskape note that the potential for encountering Aboriginal cultural heritage in the project area is mitigated to some extent by the moderate degree of disturbance that has occurred over many years in the project area.

A summary of the predictive model is as follows:

- **scar trees** – likely to be present on mature eucalypt trees;

- **stone artefacts and isolated finds** – could be found across the project area and likely near the Belubula river and other water sources (typically within 200 m);
- **burial sites** – unlikely to occur in the project area;
- **earthen features including mounds, ovens, hearths, stone arrangements and ceremonial rings** – could be found on level ground near water sources in the project area. However, their likelihood is lessened because previous land disturbance such as earthworks associated with quarrying and mining activities, grading roads and fence lines and ploughed cultivation during agricultural cropping is likely to have destroyed such features, had these site types originally occurred in the project area; and
- **rock shelters, rock art and quarries** – rock shelters and rock art are not likely to occur in the project area due to absence of suitable rock outcrops. Bedrock suitable for quarrying by Aboriginal people may occur at exposed outcrops in the project area.

15.5.2 Archaeological survey

As noted in Section 15.3.2, Navin Officer (2017) completed an initial desktop review of the project area and a field survey from 18 April 2017 and 11 May 2017. This was attended by representatives from Navin Officer and the OLALC.

Additional field surveys were conducted by a representative of Landskape and a representative of the OLALC on 31 October 2017, 25-27 September 2018 and 31 January 2019. The area covered by field surveys (ie the study area of the archaeological assessment) is shown in Figure 15.1.

Field surveys were conducted on foot in the disturbance footprint and included closely spaced transects ranging from 10 to 50 m to cover the study area. The ground surface was examined for stone artefacts, axe-grinding grooves, hearths, hearthstones, shells, bones and mounds. Landskape (2019) notes that ground surface visibility ranged from 5% to 60%. All mature trees in the study area were examined for trees scars. Approximately 14% of the surface area of the project area was effectively surveyed. This is a relatively high survey coverage and was a result of the intense nature of the survey and the generally good conditions of the surface visibility.

15.6 Field survey results

Landskape (2019) recorded 37 unregistered Aboriginal sites (MGP-A1 to MGP-A37) during their field survey, comprising:

- 19 small scatters of stone scatters; and
- 18 isolated finds of stone artefacts.

The Aboriginal sites identified by Landskape are illustrated in Figure 15.1.

The previously recorded site in the project area (KP-OS-02) could not be re-identified during field surveys conducted for the mine development. This site was identified by Kelton (2000) and is in the bottom south-east of the project area near the Mid-Western Highway, as shown in Figure 15.1.

15.7 Significance assessment

15.7.1 Overview

Heritage sites, objects and places hold value for communities in different ways. The nature of those heritage values is an important consideration when deciding on how to manage heritage sites, objects and places with competing land use options.

Landskape (2019) completed an assessment of significance for MGP-A1 to MGP-A37 which considered:

- scientific significance, including integrity, structure, content and rarity of the site;
- significance to the Aboriginal community;
- educational significance; and
- aesthetic significance.

The scientific, educational and aesthetic significance of all 38 sites was assessed as low and the significance to the Aboriginal community as moderate. The significance assessment is summarised below.

15.7.2 Socio-cultural and historic value: significance for the Aboriginal community

Aboriginal heritage sites with archaeological evidence are of value to the Aboriginal community through the tangible connection they represent of pre-colonial Aboriginal land use. It is acknowledged that the Aboriginal community consider Aboriginal objects as culturally significant items.

Research and consultation with the Aboriginal community was conducted to determine whether any socio-cultural heritage value relates specifically to the project area regardless of archaeological evidence. This was primarily established through consultation with OLALC during field surveys, who did not identify a high spiritual, traditional, historical or contemporary association with the sites identified in the project area.

15.7.3 Scientific values

Scientific values were determined according to a site's integrity, structure, contents and rarity. Each value was rated as having a 'low', 'moderate' or 'high' rating based on the its individual characteristics. All 38 sites were assessed to have low scientific significance across all values (Landskape 2019).

15.7.4 Educational and aesthetic significance

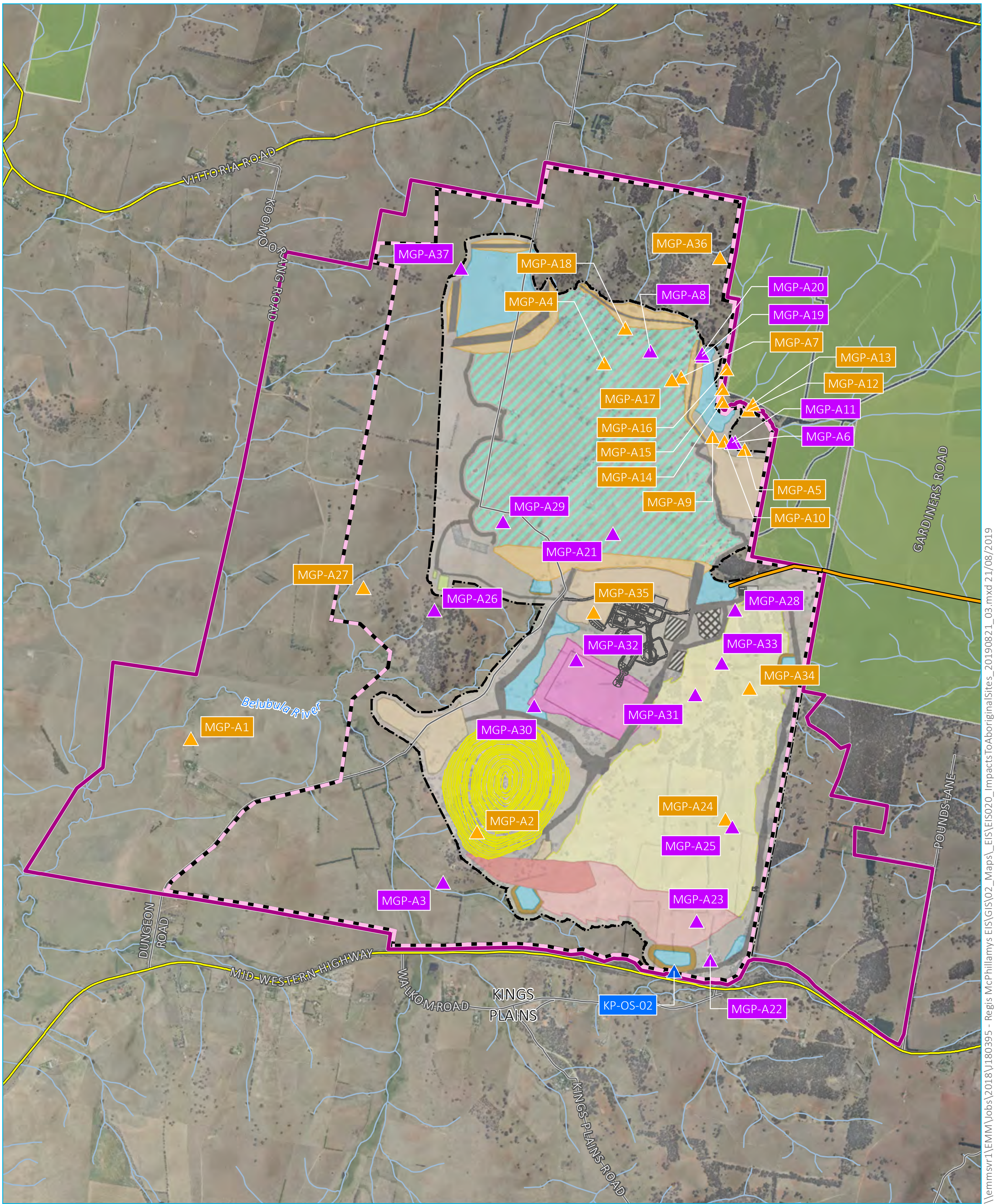
Educational significance was determined according to the site's potential to educate the public about Aboriginal heritage. Aesthetic significance was based upon the scale, form, materials, texture, colour, space and relationship of the components of the site. All 38 sites were assessed to have low educational and aesthetic significance.

15.8 Impact assessment

Twenty three sites identified in the project area will be subject to direct disturbance as a result of the mine development, as shown in Figure 15.2. These sites are in the direct disturbance footprint associated with the key features of the mine, such as the open cut void, waste rock emplacement, mine infrastructure areas and the TSF.

A further ten sites are in the overall disturbance footprint that has been defined for the project, which comprises both the direct footprint associated with the key features of the mine (such as the open cut void, waste rock emplacement, mine infrastructure areas and the TSF), as well as buffer areas around these key pieces of infrastructure. These sites are in the buffer areas and therefore may be subject to some level of disturbance. The remaining five sites are outside of the overall disturbance footprint and will therefore not be impacted by the mine development.

The impacts of the mine development on Aboriginal heritage sites identified in the project area are summarised in Table 15.3.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); Landskape (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 55
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KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Project general arrangement
- Open cut mine
- Plant layout
- Road
- Mine administration
- Workshop
- Mining equipment areas
- Magazine and ammonium nitrate emulsion storage
- Southern amenity bund
- Pit amenity bund
- ROM
- Topsoil zone
- Embankment
- Dam/water storage/sediment basin
- Sediment basin structure
- Waste rock emplacement
- Tailings storage facility

Existing environment
- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

Aboriginal heritage site (Landskape, 2019)
- Artefact scatter (19)
- Isolated find (18)

Previously recorded site
- Open artefact site (1)

Impacts to Aboriginal cultural heritage sites in the mine project area

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Figure 15.2

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EMM creating opportunities

Table 15.3 Potential impacts and consequences to Aboriginal heritage sites from the mine development

Site number	Potential impact	Potential consequence
MGP-A1 MGP-A3 MGP-A26 MGP-A27 MGP-A36	None	None
MGP-A5 MGP-A6 MGP-A9 MGP-A10 MGP-A11 MGP-A12 MGP-A13 MGP-A15 MGP-A16 MGP-A37	None/indirect	None/possible harm to site
MGP-A2 MGP-A4 MGP-A7 MGP-A8 MGP-A14 MGP-A17 MGP-A18 MGP-A19 MGP-A20 MGP-A21 MGP-A22 MGP-A23 MGP-A24 MGP-A25 MGP-A28 MGP-A29 MGP-A30 MGP-A31 MGP-A32 MGP-A33 MGP-A34 MGP-A35 AHIMS #44-2-0122	Direct	Destruction of site

As discussed in Section 15.7, Landskape (2019) assessed the scientific, educational and aesthetic significance of the 37 newly identified sites as low and the significance to the Aboriginal community as moderate.

There is potential for additional sites to exist in the project area; however, it is unlikely that these artefacts would be in-situ due to past land disturbance. Additionally, there are no culturally sensitive landforms located in the project area.

Landskape (2019) notes that although the sites in the project area are representative of a region wide distribution of Aboriginal occupation sites, they hold low scientific significance and are significantly disturbed. Considering this, the mine development and subsequent site destruction would not cause cumulative impact to the region's Aboriginal heritage value.

15.9 Management measures

A summary of the management measures to be applied to sites MGP-A1 to MGP-A37 and AHIMS #44-2-0122 is provided in Table 15.4. These management measures were established in consultation with the OLALC.

Table 15.4 Proposed management measures for Aboriginal heritage sites in the mine project area

Site number	Proposed management measure
MGP-A1	Avoid harm by protective barrier
MGP-A2	Salvage Aboriginal objects
MGP-A3	Avoid harm by protective barrier
MGP-A4	Salvage Aboriginal objects
MGP-A5	Avoid harm or salvage Aboriginal objects
MGP-A6	Avoid harm or salvage Aboriginal objects
MGP-A7	Salvage Aboriginal objects
MGP-A8	Salvage Aboriginal objects
MGP-A9	Avoid harm or salvage Aboriginal objects
MGP-A10	Avoid harm or salvage Aboriginal objects
MGP-A11	Avoid harm or salvage Aboriginal objects
MGP-A12	Avoid harm or salvage Aboriginal objects
MGP-A13	Avoid harm or salvage Aboriginal objects
MGP-A14	Salvage Aboriginal objects
MGP-A15	Avoid harm or salvage Aboriginal objects
MGP-A16	Avoid harm or salvage Aboriginal objects
MGP-A17	Salvage Aboriginal objects
MGP-A18	Salvage Aboriginal objects
MGP-A19	Salvage Aboriginal objects
MGP-A20	Salvage Aboriginal objects
MGP-A21	Salvage Aboriginal objects
MGP-A22	Salvage Aboriginal objects
MGP-A23	Salvage Aboriginal objects
MGP-A24	Salvage Aboriginal objects

Table 15.4 Proposed management measures for Aboriginal heritage sites in the mine project area

Site number	Proposed management measure
MGP-A25	Salvage Aboriginal objects
MGP-A26	Avoid harm by protective barrier
MGP-A27	Avoid harm by protective barrier
MGP-A28	Salvage Aboriginal objects
MGP-A29	Salvage Aboriginal objects
MGP-A30	Salvage Aboriginal objects
MGP-A31	Salvage Aboriginal objects
MGP-A32	Salvage Aboriginal objects
MGP-A33	Salvage Aboriginal objects
MGP-A34	Salvage Aboriginal objects
MGP-A35	Salvage Aboriginal objects
MGP-A36	Avoid harm by protective barrier
MGP-A37	Avoid harm or salvage Aboriginal objects
AHIMS #44-2-0122	Salvage Aboriginal objects

As presented in Table 15.4, 23 sites will be salvaged prior to land disturbance, in collaboration with RAPs. The keeping place for salvaged artefacts will be determined as part of the development of the CHMP and in consultation with RAPs and OEH.

Protective barriers will be erected around the five sites that are outside of the proposed disturbance footprint to provide added protection from inadvertent disturbance; namely MGP-A1, MGP-A3, MGP-A26, MGP-A27 and MGP-A36. The remaining sites are in proximity to proposed surface disturbance activities and Landskape (2019) recommend these sites be salvaged if impact is unavoidable.

Further to the management of specific sites, the following mitigation and management measures will be implemented to ensure the appropriate management of Aboriginal heritage within the project area:

- invitation for the continued participation of RAPs; in particular for the recording, collection, curation, storage and replacement of artefacts;
- provision of cultural awareness training for site personnel, likely through the site induction process;
- the preparation of a cultural heritage management plan (CHMP), which will guide the mitigation and management of sites in the project area and help to avoid inadvertent impacts. The CHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains; and
- Regis will consult with the Orange Local Aboriginal Land Council regarding the commission of a social and cultural mapping study with relevant traditional owners for the project area.

15.10 Conclusion

Thirty eight Aboriginal heritage sites have been identified in the project area, 23 of which are in the footprint of either the open cut area, tailings storage facility, waste rock emplacement area or surface infrastructure and therefore would be directly impacted by land disturbance, including AHIMS #44-2-0122. These sites will be salvaged prior to land disturbance. Disturbance to a further 10 sites may occur as they are within close proximity to these areas and sit within the overall disturbance footprint identified for the project.

Landskape (2019) has assessed the scientific, educational and aesthetic significance of the sites as low and the significance to the Aboriginal community as moderate. Disturbance to these sites will not greatly impact the Aboriginal heritage value of the project area or region or cause cumulative impact, considering the implementation of management measures outlined in Section 15.9.

A CHMP will be prepared to guide the mitigation and management of sites in the project area and to avoid inadvertent impacts. The CHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains.

Chapter 16

Historic heritage

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16 Historic heritage

16.1 Introduction

This chapter provides a summary of the historic heritage assessment that was undertaken by Landskape (2019) as part of the Aboriginal and historical cultural heritage assessment of the mine development. It describes the historical context in and surrounding the project area, outlines potential heritage items identified in the project area, and assess the potential impact of the mine development on historical heritage. The full technical report is provided in Appendix P.

The EARs require an assessment of the mine development's potential impact on historic heritage. The requirements and EIS sections where they are addressed are listed in Table 16.1.

Table 16.1 Historic heritage related EARs for the mine development

Requirement	Where addressed
Heritage – including • an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with Aboriginal stakeholders having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH 2011); and • an assessment of the impact on environmental heritage in accordance with the NSW Heritage Manual, including heritage conservation areas and State and local heritage items within and near the site, and detailed mitigation measures to offset potential impacts on heritage values.	This chapter addresses historic heritage. Aboriginal cultural heritage is addressed in Chapter 15 and Appendix P.

The heritage assessment was guided by the following documents to fulfil the EARs:

- *Historical Archaeology Code of Practice* (NSW Heritage Office 2006);
- *NSW Heritage Manual* (NSW Heritage Office 1996);
- *Assessing Heritage Significance* (NSW Heritage Office 2001); and
- *Australian International Council on Monuments and Sites, Charter for Places of Cultural Significance* (also known as the *Burra Charter*, Australia ICOMOS 2013).

The field survey conducted for the heritage assessment (Landskape 2019) focused on sites located within the proposed disturbance footprint. Sites located in the broader lease application area were also assessed.

16.2 Existing environment

16.2.1 Historical context

i Exploration and early settlement

The earliest colonial presence in the Bathurst region dates back to 1815, when surveyor George Evans led an expedition which extended south of Bathurst through the middle reaches of the Belubula River to Kings Plains and east of what would become Blayney.

Governor General Macquarie started to publicly grant land west of the Macquarie River in the 1830s. This led to the initial settlement of squatters and estate commissioners in the Kings plains area. Settlement was exacerbated by the discovery of the Victoria Pass in 1832 which provided access between Sydney and Bathurst.

The introduction of the *Lands Act 1862* led to the establishment of infrastructure by pastoralists, including homesteads, fencing, stockyards, sheds and wool scours. Towards the end of the nineteenth century, large pastoral runs were subdivided and wheat growing became the primary pastoral land use.

The project area is located within the historical parish maps for Torrens and Vittoria.

ii Historical pastoralism

Historical pastoralism in the project area dates back to 1838 and was focused along the Belubula River.

From 1834, the wool industry was expanding in the central west of NSW. This led to interest in free Crown land in the region forcing squatters to formalise their land leases or purchases. The Robertson Land Acts of 1861 led to the further uptake of Crown land in the region. Pastoral occupation in the project area initially consisted of smaller land holdings which were consolidated at the start of the twentieth century.

Historical pastoralists James Death and John McPhillamy held the largest portions of land in the Kings Plains area at the start of the twentieth century, which were eventually transferred to the Marriott and Wilde families. By this time, sheep and cattle grazing as once a popular land use of the nineteenth century had turned to the production of wheat and hay.

iii Historical mining

There is a long history of gold mining activity in the Blayney region, including within the project area. Gold fields in Blayney and Kings Plains were first gazetted in the late 1850s and established on Crown land. Gold was first prospected at McPhillamys Hill in the project area by Charles Sherlock as part of the gold rush of the 1850s which included the mining of alluvial deposits.

In the late nineteenth century gold mining leases were established on private land in the Blayney region under the *Mining on Private Lands Act 1894*. McPhillamys Hill Mine was established in the late 1880s by a Sydney based company who established two shafts. This was ultimately unprofitable and taken over by Sampson in 1903. A second mine was established in the project area on Portion 29 by Letondeur who established four shafts. In 1918, Charles Sherlock also held a gold mining lease for Portion 29 in the project area.

By the end of nineteenth century, a decrease in gold returns was reported from the mines within the project area. During this time, copper was discovered in the region, which led to the uptake of copper mining, smelting and the transport of iron to Lithgow.

Mining occurred sporadically in the region until the 1940s when large scale gold mines were established in Browns Creek and Junction Reefs, west of Blayney.

16.2.2 Listed heritage items

There are no heritage items listed under the Blayney LEP, Cabonne LEP or on the State Heritage Register, which is governed by the *Heritage Act 1977,* in the project area.

As shown in Figure 16.1, a number of listed heritage items are in the vicinity of the project area.

Some items listed on the Blayney LEP as having local significance are immediately south of the project area in Kings Plains, on the southern side of the Mid-Western Highway. These include:

- Lynfern (I203) – homestead, garden, stables and woolshed;
- Iralee (I202) – homestead, gardens and outbuildings;
- Karella (I206) – homestead and garden;
- Public school (I208) – public school and teacher's residence (former);
- Anglican church (I201); and
- Last Chance Mine (I200) – the former workings of the mine.

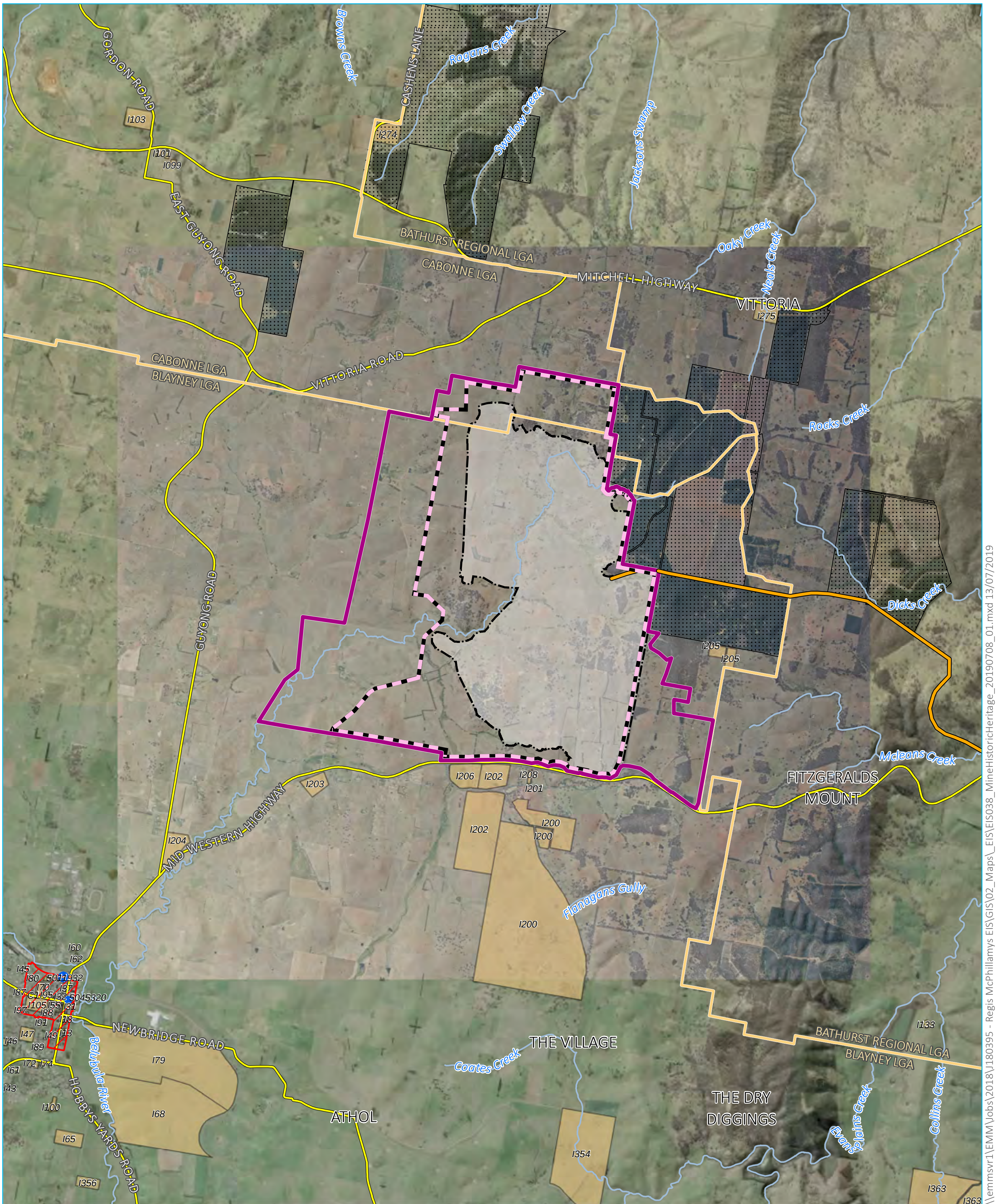
A woolshed (I1204) is also located to the south-west of the project area on the corner of Guyong Road and the Mid Western Highway. Another woolshed (I205) is to the east, adjacent to the Vittoria State Forest. A number of locally listed heritage items are also located further from the project area, around the Blayney township.

In the Bathurst LGA, the locally listed BeeKeepers Inn is approximately 3 km from the northern boundary of the project area. This property comprises a commercial honey business and includes a café and farm shop.

16.2.3 Newly identified items

Pedestrian surveys completed as part of the heritage assessment identified 23 historical heritage sites in the project area (numbered MGP-H1-MGP-H23). These sites are shown in Figure 16.2, and some examples are illustrated in Plates 16.1 and 16.2.

The sites are representative of pastoral and mining activities of the late nineteenth century. They comprise historic dwellings and dwelling ruins, mining sites (shafts, an adit and a survey marker tree), domestic and pastoral refuse dumps, small bridges and pastoral sites (sheds, stockyards). The significance of the sites identified are discussed in following Section 16.4.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); DPE (2017); ELVIS (2014)

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Mine development project area (2,513.47 ha)
Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
Disturbance footprint
Pipeline corridor

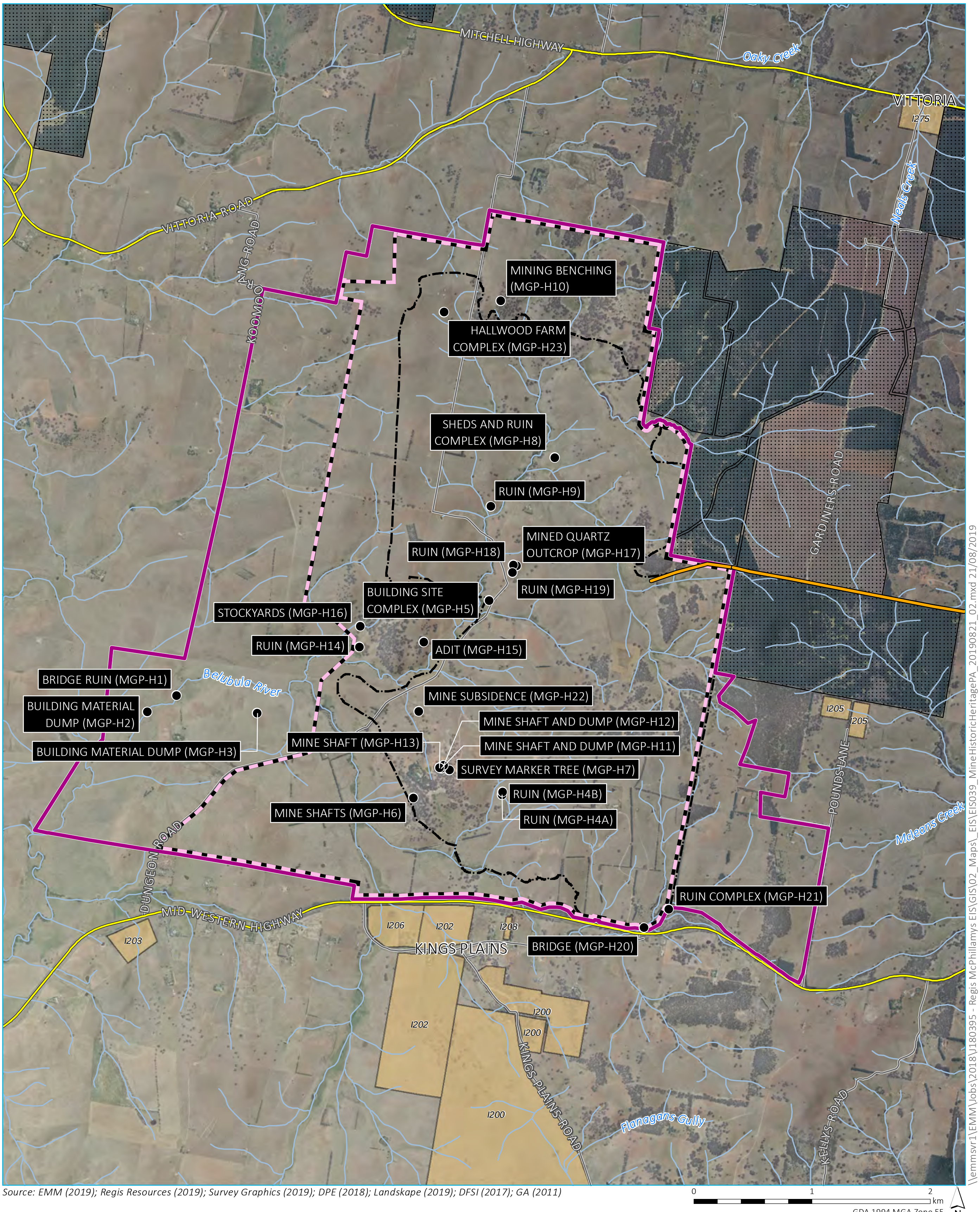
Existing environment
Main road
Named watercourse
Vittoria State Forest
Local government area

Historic heritage items
State Heritage Act
Conservation Area - General
Item - General

Listed historic heritage items in the vicinity of the mine development

McPhillamys Gold Project
Environmental impact statement
Figure 16.1

REGIS RESOURCES LTD
EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DPE (2018); Landskape (2019); DFSI (2017); GA (2011)

KEY

- Cultural heritage site (Landskape, 2019)
- Item - General

Project application area

- Mine development project area (2,513.47ha)
- Mining lease application area (1,812.99 ha)
- Disturbance footprint
- Pipeline corridor

Existing environment

- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

Historic heritage sites in and surrounding the mine project area

McPhillamys Gold Project
Environmental impact statement
Figure 16.2

REGIS RESOURCES LTD

EMM creating opportunities

Plate 16.1 Exterior of hut at complex MGP-H5

Plate 16.2 Mine shafts - MGP-H6

16.3 Assessment of significance

The criteria of the State Heritage Register were applied to assess the significance of the sites identified in the project area:

a) *an item is important in the course, or pattern, of NSW's cultural or natural history;*

b) *an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history;*

c) *an item is important in demonstrating aesthetic characteristic and/or a high degree of creative or technical achievement in NSW;*

d) *an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;*

e) *an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history;*

f) *an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history; and*

g) *an item is important in demonstrating the principle characteristics of a class of NSW's cultural or natural places or cultural or natural environments.*

A summary of the assessment of significance of each site is provided in Table 16.2.

Table 16.2 Assessment of significance of historical heritage sites in the mine project area

Site number	Site Type	Significance
MGP-H1	Bridge ruin	Does not meet criteria
MGP-H2	Building material dump	Does not meet criteria
MGP-H3	Building material dump	Does not meet criteria
MGP-H4a and MGP-H4b	Ruin	Criteria (e) and (g)
MGP-H5	Building complex	Criteria (e), (f) and (g)
MGP-H6	Mine shafts	Criteria (a)
MGP-H7	Survey marker tree	Criteria (b), (f) and (g)
MGP-H8	Shed and ruin complex	Does not meet criteria
MGP-H9	Ruin	Criteria (e) and (g)
MGP-H10	Mining benching	Does not meet criteria
MGP-H11	Mine shaft and dump	Criteria (a) and (b)
MGP-H12	Mine shaft and dump	Criteria (a) and (b)
MGP-H13	Mine shaft	Criteria (a), (b) and (g)
MGP-H14	Ruin	Criteria (e) and (g)
MGP-H15	Adit	Criteria (a) and (g)

Table 16.2 Assessment of significance of historical heritage sites in the mine project area

Site number	Site Type	Significance
MGP-H16	Stockyards	Does not meet criteria
MGP-H17	Mined quartz outcrop	Does not meet criteria
MGP-H18	Ruin	Criteria (e) and (g)
MGP-H19	Ruin	Criteria (e) and (g)
MGP-H20	Bridge	Does not meet criteria
MGP-H21	Ruin complex	Criteria (e) and (g)
MGP-H22	Mine subsidence	Does not meet criteria
MGP-H23	Hallwood Farm Complex	Meets all criteria for local significance. Could have state significance values.

As evident in Table 16.2, 13 sites meet some of the criterion as having local significance. One site, MGP-H23 (the Hallwood Farm Complex), meets all the criteria, and was assessed by Landskape as potentially holding some State significant values.

Hallwood is a small 19th Century land holding and dwelling, consisting of a timber framed lath-and-plaster dwelling, two corrugated iron sheds and a brick underground tank. It was built by William Jenner and first recorded in Portion 96 of the 1868 Parish of Vittoria map. The original two-bedroom dwelling was extended at some point in time, including the construction of an additional bedroom and skillion roof. The local motorcycle community completed maintenance on the dwelling in the 1980s including the northern wall and kitchen. The dwelling is shown in Plate 16.3.

The Parish of Vittoria map (1884) shows the 40 acre lot on which Hallwood is located was owned by William Jenner, who conditionally purchased the lot in 1868. The Parish of Vittoria map (1894) marks a "hut" where the dwelling is located. Thus, the dwelling predates selection and the oldest phase of construction is probably mid-nineteenth century.

Landskape engaged conservation architect Christo Aitken to undertake initial research and investigations of this site and provide recommendations as to the management of this site. His preliminary findings have been incorporated into the heritage assessment with the full Stage 1 Report (Christo Aitken + Associates 2019) appended to Landskape (refer to Appendix 5 of Appendix P).

In his initial assessment, Christo Aitken found that the site is likely to have high historical, associational, aesthetic and technical values. It may have been one of the first structures in the Vittoria area, and the historic and associational significance values relate to the construction of part of the dwelling possibly between 1841 and 1860. Early surveys show that it was associated with extensive stockyards and rustic fencing. Aitken also considered the Hallwood dwelling to hold aesthetic and technical significance values as it is may be a rare survivor of an early 1800s slab timber shepherd's hut. Further research has been recommended to clarify aspects of the history and physical fabric of the dwelling, and in particular its association with the McPhillamy family.

As noted in Chapter 4, consultation with Department of Premier and Cabinet, Heritage, Community Engagement (Heritage, Community, Engagement) and Cabonne Council has been carried out with regard to the findings of the historic heritage assessment. Consultation with Heritage, Community Engagement confirmed further research into the heritage significance of Hallwood would be required, particularly in terms of determining the significance of the built fabric and technical details of the Hallwood dwelling.

It was therefore recommended, that a built heritage specialist be engaged to further assess the built fabric and construction techniques of Hallwood with consideration given to carrying out a comparative analysis on the number, location and condition of similarly constructed heritage items already listed on local and state heritage registers in the local area and wider region. Heritage, Community, Engagement also confirmed subsurface testing should be carried out to determine archaeological significance of Hallwood.

Consultation with Cabonne Shire Council revealed that the Cabonne LEP includes heritage items based on a community based heritage study in 2006 wherein Cabonne residents were invited to identify items of value to the community. This study and the subsequent LEP of 2012 did not receive any representations for Hallwood to be incorporated as a locally significant item. Accordingly It is not anticipated that Hallwood would require adding to Cabonne LEP's listed heritage items.

Plate 16.3 Hallwood farm complex (MGP-H23)

16.4 Assessment of impact

16.4.1 Sites within the project area

Landskape (2019) applied the following three categories when assessing the direct impacts of the mine development on the sites identified within the disturbance footprint:

- the loss of information which could otherwise be gained by conducting research today;

- the loss of the cultural heritage resource for future research using methods and addressing questions not available today; and
- the permanent loss of the physical record.

Depending on the significance of the site, these impacts can be mitigated to various degrees. The disturbance of sites with low significance will cause minimal impact, as these sites may not offer useful information or there may be similar or alternative sites. Sites that hold greater significance may provide useful information which warrants avoidance or the relocation or salvaging of artefacts prior to disturbance.

Indirect impacts may affect sites which are not in the disturbance footprint of the proposed mine development and could result from:

- dust deposition;
- structural damage due to vibration from blasting;
- accidental disturbance from peripheral activities; and
- damage from inappropriate visitation or unauthorised removal of artefact.

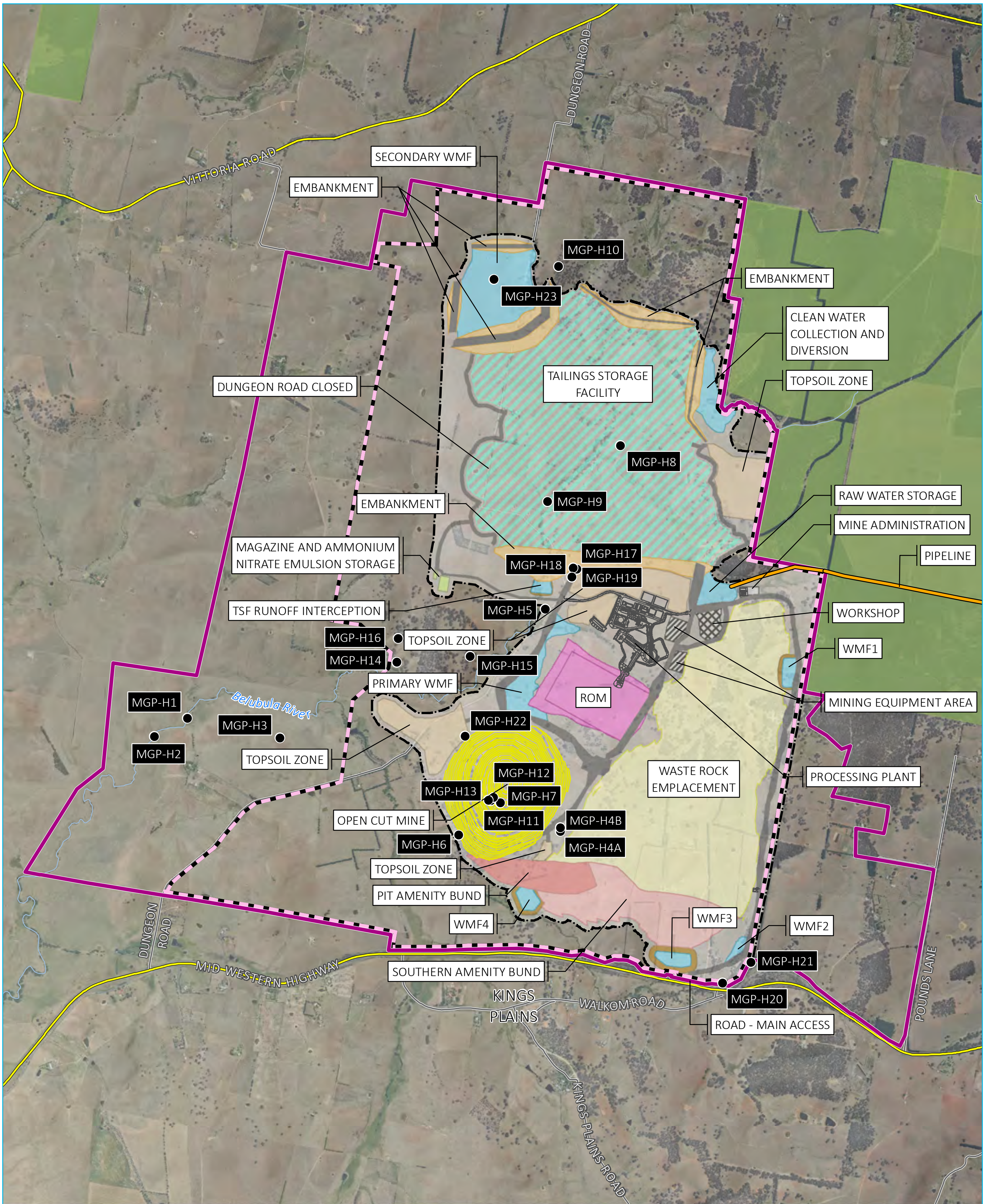
The potential for impact to each of the newly identified sites is summarised in Table 16.3, including the potential consequence to the site should the mine development be approved. Figure 16.3 illustrates the sites to be impacted.

Table 16.3 Potential impact and consequence to historical heritage sites in the mine project area

Site number	Significance	Potential impact	Potential consequence
MGP-H1	n/a	None	None
MGP-H2	n/a		
MGP-H3	n/a		
MGP-H10	n/a		
MGP-H14	Local (e, g)		
MGP-H15	Local (a, g)		
MGP-H16	n/a		
MGP-H20	n/a		
MGP-H21	Local (e, g)		
MGP-H4a	Local (e, g)	None/indirect	None/possible harm to site
MGP-H4b	Local (e, g)		
MGP-H5	Local (e, f, g)		
MGP-H19	Local (e, g)		

Table 16.3 Potential impact and consequence to historical heritage sites in the mine project area

Site number	Significance	Potential impact	Potential consequence
MGP-H6	Local (a)	Direct	Destruction of site
MGP-H7	Local (b)		
MGP-H8	n/a		
MGP-H9	Local (e, g)		
MGP-H11	Local (a, b)		
MGP-H12	Local (a, b)		
MGP-H13	Local (a, b, g)		
MGP-H17	n/a		
MGP-H18	Local (e, g)		
MGP-H22	n/a		
MGP-H23	Local (a, b, c, d, e, f, g)		



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); Landskape (2019); DPE (2018); DFSI (2017); GA (2011)

KEY

- Cultural heritage site (Landskape, 2019)

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Project general arrangement
- Plant layout
- Road
- Water management facility (WMF)
- Sediment basin structure

Existing environment
- Main road
- Local road
- Belubula River
- Vittoria State Forest

Impacts to historic heritage sites in the mine project area

McPhillamys Gold Project
Environmental impact statement
Figure 16.3

As can be seen in Table 16.3 and Figure 16.3, nine sites will be unimpacted by the mine development as they are outside of the disturbance footprint.

Sites MGP-H4a, MGP-H4b, MGP-H5 and MGP-H19, whilst located in the overall disturbance footprint of the mine as illustrated in Figure 16.3, are within buffer areas around infrastructure elements of the mine. These sites therefore may be unimpacted, although it is likely they will be subject to some form of disturbance. Eleven sites are located in the direct disturbance footprint, seven of which are considered by Landskape (2019) to be of local significance, and one, MGP-23 (Hallwood Farm Complex), may be of higher significance (Christo Aitkin + Associates 2019).

Sites MGP-H9 and MGP-18 (both ruins) may have some subsurface archaeological potential. These two sites are in the footprint of the TSF, and therefore, as described in Section 16.5, Landskape recommends that subsurface testing is undertaken of these sites.

With the exception of MGP-23 (Hallwood Farm Complex), Landskape (2019) notes that although the sites in the project area are representative of the local heritage context of the region, they are significantly disturbed. Considering this, the destruction of these sites as a result of the mine development will not cause cumulative impact to the region's local heritage value.

Both Landskape (2019) and Christo Aikin + Associates (2019) recommended that due to the local and potential state significance of MGP 23 (Hallwood Farm Complex), impact to this site should be avoided and a detailed assessment and a conservation management plan prepared.

As outlined in Section 6.8, options to avoid the site have been explored through the investigation of alternative locations for the Secondary WMF. However due to site constraints including the presence of CEEC Box Gum Woodland, prevailing topography of the site and water management considerations (ie to accommodate a WMF of the required storage that will not spill externally but rather to the TSF), the current location has been confirmed as the most appropriate location when all environmental, social and economic factors are considered.

As noted above, this study and the subsequent LEP of 2012 did not receive any representations for Hallwood to be incorporated as a locally significant item. Accordingly, it is not anticipated that Hallwood would require adding to Cabonne LEP's listed heritage items. Archival recording of Hallwood prior to destruction is considered to be an appropriate management strategy.

16.4.2 Sites outside the project area

As discussed in Section 16.3, a number of historic heritage sites of local significance, listed on the Blayney LEP, are in the vicinity of the project area; the closest ones being in Kings Plains, south of the Mid-Western Highway (refer to Figure 16.1), and the woolshed to the east (I205).

The potential for these sites to be impacted has been considered in relation to the potential from noise and vibration, air quality, and groundwater drawdown.

The noise and vibration impact assessment (MAC 2019, refer to Appendix L) calculated the maximum instantaneous charge (MIC) that could be used within the project area such that the overpressure and vibration levels would remain within the relevant criteria at neighbouring sensitive receivers (including heritage listing buildings), thereby avoiding impacts. The assessment recommended a MIC of 300 kg. The predicted maximum air blast overpressure and vibration levels at the listed heritage items associated with an MIC of 300 kg are presented in Table 16.4.

Table 16.4 Blasting emissions from the mine development and historic heritage sites

Sensitive receiver ID or heritage item number	Distance to charge (m)	Airblast overpressure (dBZ Peak)	Ground vibration (mm/s)
I201	1365	113	1.1
I202	1383	113	1.0
I203	3020	103	0.3
I204	5084	96	0.1
I205	3527	101	0.2
I206	1263	114	1.2
I208	1288	114	1.2

As shown, the maximum vibration levels predicted at the nearby heritage listed sites is 1.2 mm/s. The maximum accepted vibration level at any residence on privately owned land is stipulated by the ANZECC guidelines as 5 mm/s; which is well above the predicted levels. Further, the international standard *DIN 4150-3 Vibration in buildings - Part 3: effects on structure,* provides safe limit values for which cosmetic damage from vibration is unlikely to occur. For sensitive buildings the limits are 3 mm/s (frequency of less than 10 Hz), 3 to 8 mm/s (frequency of 10-50 Hz) and 8 to 10 mm/s (frequency of 50-100 Hz). At a maximum vibration of 1.2 mm/s, the predicted vibration levels from the mine development at nearby heritage listed items are well below the safe limits specified in DIN 4150-3.

In relation to groundwater, and as described in Chapter 9, the groundwater model predicts drawdown to remain tight around the open cut, with a drawdown of less than 1 m predicted outside of the project area. No impacts to heritage listed buildings will therefore occur as a result of groundwater drawdown.

The air quality assessment found that, with appropriate dust management measures in place, emissions at nearby receptors, including heritage listed sites, will be well within the relevant EPA criteria.

16.5 Management measures

With the possible exception of MGP-23 (Hallwood), the historic heritage items identified in the project area do not hold high scientific, social or cultural significance. Notwithstanding, the following general management measures will be implemented to enable the effective management of heritage sites in the project area:

- preparation of a cultural heritage management plan (CHMP), which will guide the mitigation and management of sites in the project area and help to avoid inadvertent impacts. The CHMP will outline the framework for the appropriate archival and salvage of sites identified in Table 16.5. The CHMP will also include a protocol for unanticipated finds such as artefacts and skeletal remains; and

- cultural awareness training for site personnel will be undertaken through the site induction process.

A summary of the specific mitigation and management measures to be applied to MGP-H1 to MGP-H23 is provided in Table 16.5.

Table 16.5 Proposed management measures for historical heritage sites in the mine project area

Site number	Proposed mitigation and management measure
MGP-H1	None
MGP-H2	None
MGP-H3	None
MGP-H4a and MGP-H4b	Avoid harm or if not possible conduct subsurface testing, archival recording and salvaging
MGP-H5	Avoid harm or if not possible conduct subsurface testing, archival recording and salvaging
MGP-H6	Archival recording
MGP-H7	Archival recording and salvage
MGP-H8	None
MGP-H9	Subsurface testing, archival recording and salvaging
MGP-H10	None
MGP-H11	Archival recording
MGP-H12	Archival recording
MGP-H13	Archival recording
MGP-H14	Avoid harm. Site to be fenced.
MGP-H15	Avoid harm. Site to be fenced.
MGP-H16	None
MGP-H17	None
MGP-H18	Subsurface testing, archival recording and salvaging
MGP-H19	Avoid harm or if not possible conduct subsurface testing, archival recording and salvaging
MGP-H20	None
MGP-H21	None – fence site.
MGP-H22	None
MGP-H23	Subsurface testing and archival recording

As illustrated in Table 16.5, the following mitigation and management measures will be implemented:

- Two sites (MGP-H9, MHP-H18) will undergo subsurface testing, archival recording and salvaging prior to destruction.
- Sites MGP-H6, MGP-H7, MGP-H11, MGP-H12 and MGP-H13 will undergo archival recording or archival recording and salvaging prior to destruction.
- Sites MGP-H8, MHP-H17 and MGP-H22 will also be directly impacted by the mine development; however Landskape (2019) propose that no management measures are required prior to destruction.
- Sites MGP-4a, MGP-4b, MGP-5 and MGP-H19, which may be indirectly impacted by the mine development, will also undergo subsurface testing, archival recording and salvaging prior to destruction if harm cannot be avoided.
- A 20 m fenced exclusion zone will be erected around MGP-H14, MGP-H15 and MGP-H21.

- Regis will engage a built heritage specialist and a historic heritage archaeologist to carry out further assessment of the Hallwood farm complex (MGP-23) as discussed with Heritage, Community and Engagement, to confirm the aesthetic, technical and archaeological significance values of the site.
- Regis will carry out archival recording of Hallwood in accordance with the methodology documented in the CHMP.
- The remaining sites are outside of the disturbance footprint and do not require management.

16.6 Conclusion

No listed heritage items occur within the mine project area. Notwithstanding, seven sites deemed to be of local significance, and one of potentially higher significance pending further research, were identified in the direct footprint of the mine development. A further four locally significant sites were found within buffer areas around the direct disturbance footprint and may therefore be subjected to some level of disturbance.

Landskape (2019) concluded that, with the exception of MGP – H23 (Hallwood Farm Complex), the disturbance to the sites in the project area would not greatly impact the historical heritage value of the project area or region or cause cumulative impact, considering the implementation of management measures described in Section 16.5.

Landskape (2019) and Christo Aikin + Associates (2019) recommended impact to MGP 23 (Hallwood Farm Complex), should be avoided and a detailed assessment and a conservation management plan prepared. Notwithstanding, consultation with Cabonne Council has indicated that archival recording of Hallwood prior to the destruction of this site, is likely to be considered by council to be an acceptable management strategy.

Options to avoid Hallwood have been explored through the investigation of alternative locations for the Secondary WMF. However due to site constraints, the current location has been confirmed as the most appropriate location when all environmental, social and economic factors are considered.

A range of mitigation and management measures will be implemented to appropriately manage the sites identified in the project area. These measures include some further subsurface testing, archival recording and/or salvaging for others, and the fencing of some sites outside of the disturbance footprint to ensure no inadvertent impacts occur. With regard to Hallwood, Regis will engage a built heritage specialist and a historic heritage archaeologist to carry out further assessment of the Hallwood farm complex (MGP-23) to confirm the aesthetic, technical and archaeological significance values of this site.

A CHMP will be prepared, which will guide the mitigation and management of sites in the mine project area and help to avoid inadvertent impacts. The CHMP will outline the framework for the appropriate archival and salvage of sites. It will also include a protocol for unanticipated finds such as artefacts and skeletal remains.

Chapter 17

Traffic and transport

REGIS RESOURCES LTD

17 Traffic and transport

17.1 Introduction

This chapter summarises the traffic and transport assessment (TTA) prepared for the mine development by Constructive Solutions (2019). The TTA is provided in full in Appendix Q. The traffic and transport related EARs are presented in Table 17.1.

Table 17.1 Traffic and transport related EARs for the mine development

Requirement	Where addressed
• An assessment of the likely traffic and transport impacts of the development on the capacity, condition, safety and efficiency of the road network and any cumulative impacts of other developments in the locality; • An assessment of the site access routes (including Mid Western Highway and Great Western Highway) and site access points in accordance with the Roads Act 1993; and • A description of the measures that would be implemented to mitigate and/or manage potential traffic impacts including a schedule of all required road upgrades, road maintenance contributions, management of oversized and over mass traffic and other traffic control measures, developed in consultation with the relevant road authority (if required).	This chapter and Appendix Q. The traffic from other developments is taken into account by the existing and forecast traffic volumes in Section 17.2.3. The Great Western Highway is addressed with regard to the pipeline development in Chapter 30.

17.2 Existing environment

17.2.1 Local road network

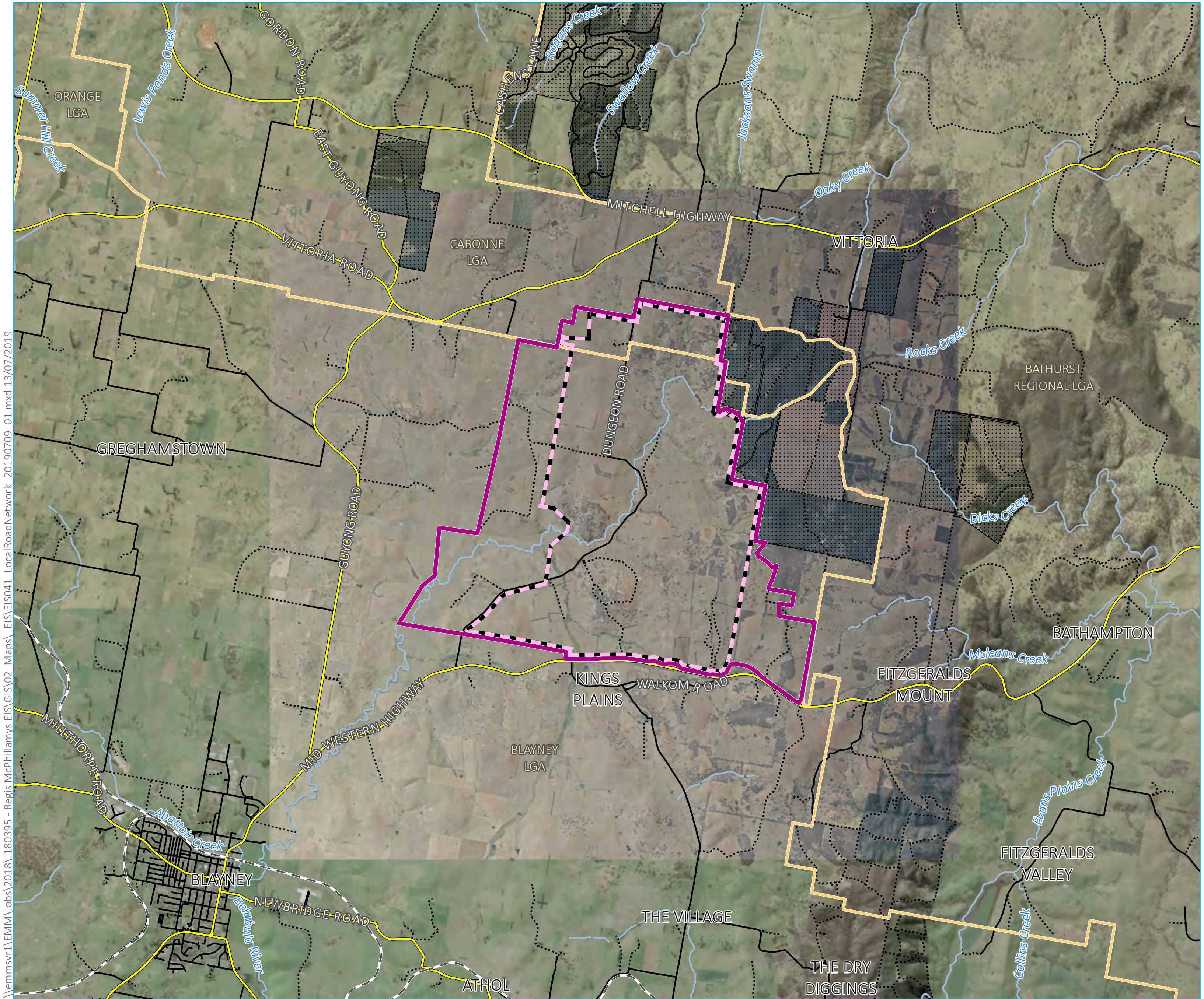
Access to the mine project area is currently from Dungeon Road via the Mid Western Highway. Traffic travelling to the project area from Blayney and Bathurst will use the Mid Western Highway whilst the majority of traffic originating from the north-west (ie Orange) are anticipated to use Vittoria Road and Guyong Road.

The Mid Western Highway is a classified road managed by RMS. All other roads in the vicinity of the mine project area are council roads managed by Blayney Shire Council and Cabonne Council. Each council is responsible for the section of each road within their LGA. The local road network is shown in Figure 17.1 and described further below.

i Mid Western Highway

The Mid Western Highway is a classified road referred to as State Highway 6 (SH6) and provides a link from Bathurst to the east with the Cobb Highway at Hay to the west. It is a transport route for regional centres including Bathurst, Blayney, Cowra, and Hay.

In the vicinity of the mine project area, the Mid Western Highway travels in an east-west direction and is a two-lane/two-way bitumen sealed road. The travel lanes are 3.5 m wide with 1 m sealed shoulders. Pavement and wearing course are considered to generally be in good condition; however, some rutting and isolated failures were observed during the inspection by Constructive Solutions (2019). The posted speed limit is 100 km/h. The Mid Western Highway is approved for B-double heavy vehicles up to 25 m in length.



KEY

Project application area

Mine development project area (2,513.47 ha)

Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)

Existing environment

Rail line

Main road

Local road

Vehicular track

Named watercourse

Vittoria State Forest

Local government area

Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)

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Local road network

McPhillamys Gold Project
Environmental impact statement
Figure 17.1

ii Dungeon Road

Dungeon Road is a local road that provides access to numerous rural properties and the mine project area. It is approximately 9.3 km long and joins the Mid Western Highway in the south and Vittoria Road to the north.

Dungeon Road is predominantly unsealed with a formation width that varies between approximately 4 m to 6 m. The gravel pavement is considered to generally be in good condition with some potholes and corrugations observed during the inspection by Constructive Solutions (2019). There is a 300 m long sealed section approximately 2.5 km north of the Mid Western Highway, which is situated in a low lying area prone to inundation during high rainfall events. The bitumen seal width is approximately 4 m to 5 m and there were a number of pothole failures observed during the site inspection.

The alignment is winding, undulating and steep in places. There are numerous substandard curves with no curve warning signs in place, including three 90-degree bends.

The LGA boundary between Blayney Shire Council and Cabonne Council is approximately 7.4 km north of the Mid Western Highway. Both ends of the Cabonne Council section of Dungeon Road are signposted with gravel road warning signs.

Delineation consists of limited guideposts only. There is no posted speed limit; however, the adjoining Mid Western Highway is signposted at 100 km/h.

iii Vittoria Road

Vittoria Road is a regional road that travels in an east-west direction between the Mitchell Highway and the town of Millthorpe. For the purpose of the TTA, a 5.2 km section of Vittoria Road from the Mitchell Highway to the Guyong Road intersection was inspected.

The 5.2 km section of Vittoria Road is sealed with bitumen, varying in width between approximately 5.5 m to 7 m. At the time of the inspection in 2017 the seal was in good condition with some pothole repairs observed in numerous locations. Line marking consists of a centre line which is faded in numerous locations.

There is no posted speed limit; however, the adjoining Mitchell Highway is signposted at 100 km/h. A 10 tonne load limit sign for through traffic only is posted at the Mitchell Highway end of Vittoria Road.

The road cross-section is typical of a rural road consisting of table drains and culvert crossings with headwalls to cater for drainage. Delineation consists of intermittent guideposts only.

iv Guyong Road

Guyong Road is a local road that joins the Mid Western Highway in the south and Vittoria Road to the north. The road is approximately 8.4 km in length and is sealed with bitumen for its entirety. Delineation consists of guideposts and centre line marking for approximately the first 2.2 km north of the Mid Western Highway. There is no posted speed limit; however, the adjoining Mid Western Highway is 100 km/h.

Pavement and seal condition vary from good to average. The bitumen seal width varies from approximately 5 m to 8 m. The road cross-section is typical of a rural road consisting of table drains and culvert crossings with headwalls to cater for drainage. The LGA boundary between Blayney and Cabonne is signposted at chainage 8.1 km.

17.2.2 Regional road network

The Great Western Highway will be used as part of the transport route for project deliveries from Sydney and is approved for heavy vehicle combinations up to 19 m in length.

The Great Western Highway is a classified road referred to as State Highway 5 (SH5). It provides a link from Sydney in the east to the Mid Western Highway at Bathurst to the west and varies in configuration from a two lane/two way road to a four lane dual carriageway.

17.2.3 Existing and forecast traffic volumes

Background traffic counts were undertaken on the Mid Western Highway, Dungeon Road and Guyong Road for a two-week period from 1 February 2017 to 16 February 2017. The current and forecast traffic volumes as annual average daily traffic (AADT) and percentage of heavy vehicles (HV%) are shown in Table 17.2.

Analysis of historic traffic counts on the Mid Western Highway from 2015 to 2017 indicated that the average growth was 1% per annum; however, for the purposes of the traffic assessment a conservative growth rate of 2% was adopted.

Table 17.2 Traffic volumes associated with the mine development

		Baseline traffic (2017)		Forecast traffic (Year 1 -2020)		Forecast traffic (Year 15 - 2034)	
Road	**Location**	**AADT**	**HV%**	**AADT**	**Road**	**Location**	**AADT**
Mid Western Highway	Proposed mine entrance	2,900	19%	3,078	19%	4,061	19%
Dungeon Road	East of existing entrance	68	17%	72	17%	95	17%
Dungeon Road	West of existing entrance	32	22%	34	15%	45	22%
Guyong Road	2.5 km north of Mid Western Highway	250	15%	265	15%	350	15%

Whilst AADT is expected to increase on each of the roads, the percentage of heavy vehicles is not expected to increase from baseline numbers on any of the roads.

The peak number of vehicles per hour on the Mid Western Highway currently occurs between 8:00 am to 9:00 am and 4:00 pm to 5:00 pm.

17.2.4 Intersections

i Mid Western Highway and Dungeon Road

The intersection of the Mid Western Highway and Dungeon Road was upgraded in 2014 in conjunction with the realignment of the highway to the west of the intersection. Turning manoeuvres are catered for on the highway with a Basic Left (BAL) turn lane for east bound traffic and a Short Channelised Right (CHR(s)) turn lane for west bound traffic.

Safe Intersection Sight Distance (SISD) is approximately 250 m to the east and approximately 300 m to the west. The give way signs on Dungeon Road are duplicated on both sides of the road and a sight board is appropriately located opposite the intersection. The bitumen seal and line marking are in good condition (refer Plates 17.1 and 17.2).

Plate 17.1 Mid Western Highway – view east from Dungeon Road

Plate 17.2 Mid Western Highway – view west from Dungeon Road

ii Dungeon Road and the existing mine access road

The intersection of Dungeon Road and the existing access to the mine project area is a basic rural T-intersection. The intersection is approximately 3.1 km north-east of the Mid Western Highway. Both Dungeon Road and the access road are unsealed. The mouth of the intersection has been constructed wide enough to cater for the turning movements of long articulated vehicles. Two warning signs are located approximately 200 m either side of the existing access to the mine project area along Dungeon Road.

Sight distance to the north-east is approximately 200 m as it is obscured by a large tree located within the clear zone. Sight distance to the south-west is also limited to approximately 200 m due to crest along Dungeon Road. (refer Plates 17.3 and 17.4).

Plate 17.3 Dungeon Road – view north-east from Dungeon Road

Plate 17.4 Dungeon Road – view south-west from Dungeon Road

17.2.5 Road safety

The most recent available five-year accident history (for 2013 to 2017) from the NSW Government Centre for Road Safety Interactive Crashes website was used to assess the crash history in the vicinity of the mine development (Constructive Solutions 2019). Three accidents each were reported on the Mid Western Highway, Guyong Road and Vittoria Road. No accidents were reported on Dungeon Road. Crash data is summarised in Table 17.3.

Table 17.3 Crash data (2013 to 2017) in the vicinity of the mine project area

Road	Location	Accident type	Degree of crash
Mid Western Highway	2-way undivided	Rear end	Moderate injury
	Walkom Rd East intersection	Head on	Serious injury
	2-way undivided	Head on	Moderate injury
Guyong Road	2-way undivided	Off bend	Moderate injury
	2-way undivided	Off bend hit object	Fatal
	2-way undivided	Leaving parking	Moderate injury
Vittoria Road	2-way undivided	Struck animal	Non-casualty
	2-way undivided	Off bend hit object	Moderate injury
	2-way undivided	Out of control on bend	Moderate injury

The number of accidents reported is minor given the volume of traffic using these roads. No repetitive or reoccurring accident patterns were identified, and it is therefore considered that the reported accident history in the vicinity of the mine development does not indicate any areas of concern within the road network.

17.2.6 Bus services

Several school buses operate along the Mid Western Highway, Walkom Road, Guyong Road and Vittoria Road during morning and afternoon school times (7:30 am to 9:00 am and 3:30 pm to 4:45 pm). The school buses stop at informal locations along these roads to pick up and drop off passengers, namely at side road intersections and property entrances. Consultation with the bus company operating the school bus services has advised that school buses currently do not stop along the Mid Western Highway but rather pick up school students residing in the Kings Plains locality at informal bus stops along Walkom Road.

Transport for NSW operates a passenger bus service between Blayney and Bathurst along the Mid Western Highway multiple times per day. There are no bus stops in the vicinity of the mine project area.

17.2.7 Pedestrian and cyclist activity

Given the rural environment, pedestrian and cyclist activity is rare in the vicinity of the project area. There are no dedicated on-road cycleways or off-road shared paths (for cyclists and pedestrians) along the surrounding road network. No pedestrians or cyclists were observed during the 2017 inspection on the Mid Western Highway or the Council roads in the vicinity of the mine project area.

17.3 Impact assessment

As outlined in Section 2.3, there will be an overlap between the construction and operational phases of the mine development. For the purposes of the TTA, the construction phase of the mine development has been defined from the start of construction works and mine development activities until the completion and commissioning of the processing plant in mid Year 2 of the project. It should be noted that the TTA has been conservative in its assumptions, assuming a peak workforce during Year 1 of approximately 636 FTE employees and construction contractors rather than the estimated 590 FTE employees and contractors anticipated by Regis.

17.3.1 Site access

Primary access to the mine will be via a new access from the Mid Western Highway, to be constructed in the south-eastern corner of the mine project area (refer Figure 2.1). The new access intersection will be constructed approximately 190 m west of the Walkom Road (east) intersection and will consist of an auxiliary left turn lane and a channelised right turn lane. The proposed intersection has been designed to cater for the worst-case scenario of peak background traffic and project related traffic. A concept design for the new site access is illustrated in Figure 17.2.

Dungeon Road will be closed to the public around 1.8 km from the Mid-Western Highway at the southern end and 1.2 km south of Vittoria Road at the northern end (or realigned as per Blayney and Cabonne Council requirements) at the start of construction activities. Construction traffic will initially access the mine project area via Dungeon Road. Once the new site access is complete the Dungeon Road access will be closed; however, access via locked gates will be maintained via Dungeon Road for emergency vehicles, environmental monitoring, mine inspections or in the event of an unplanned blockage of the new site access.

It is proposed that the first kilometre of the new access road from the Mid Western Highway will be sealed with bitumen and the remainder will be constructed as an all-weather unsealed road to enable access at all times.

17.3.2 Traffic related impacts during construction

A conservative assessment of anticipated daily personnel numbers and daily vehicle movements that will be generated by each of the project phases are presented graphically in Figure 17.3 and Figure 17.4. Operational personnel shown on these figures during Year 1 and the first half of Year 2 refer to mining contractors who will be carrying out mine development activities. These personnel will transition to mining operations around the beginning of Year 2.

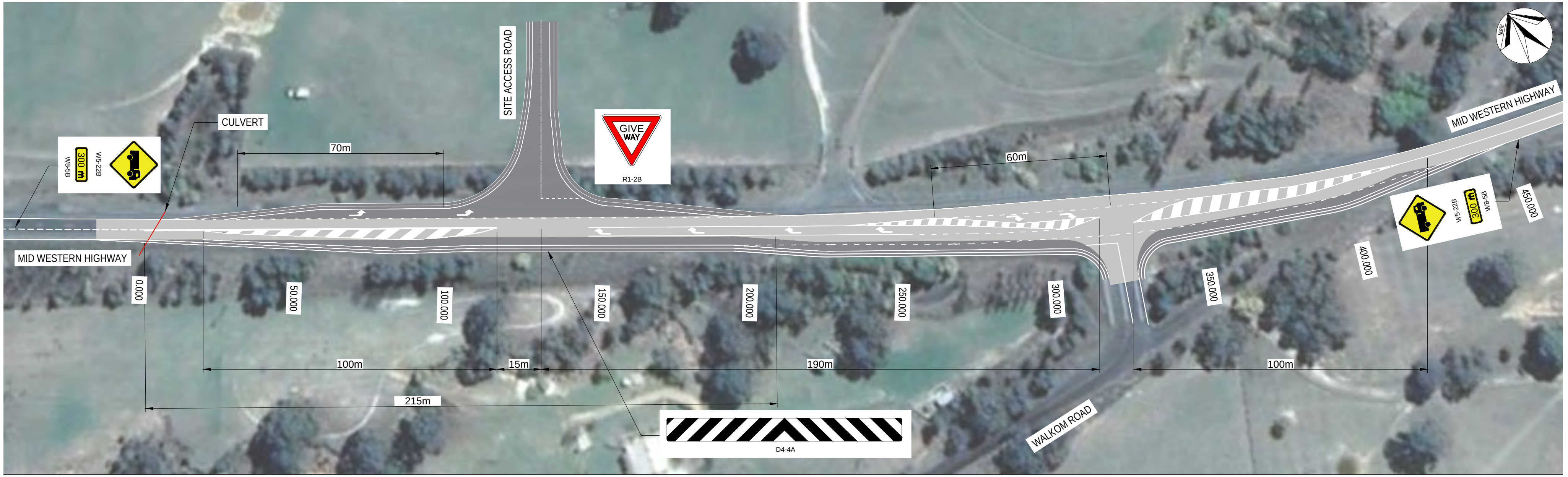
Construction work will generally be carried out during standard construction hours for the first six months, as described in Section 2.5.11. After around six months, construction and mine development activities will be carried out 24 hours and 7 days per week in 12-hour shifts, changing over at around 6:00 am and 6:00 pm. Construction personnel will undertake rotating shifts of 4 weeks on and 1 week off resulting in a maximum of 80% of these workers within the mine project area during any one day.

As shown in Figure 17.3, peak project-related construction traffic is expected to occur during the second half of Year 1 due to mine development activities, construction of the processing plant and other site construction works being carried out concurrently.

Workers during the construction phase are likely to commute to the mine project area from the towns in the surrounding area including Blayney, Bathurst, Orange and Cowra. It has therefore been estimated that 80% of the construction workforce traffic will originate from the west (Blayney and Orange) and 20% will originate from the east (Bathurst).

The majority of construction personnel are expected to be transported to the mine project area in mini buses with the remainder using light vehicles with some workers anticipated to carpool. The average occupancy rate of each vehicle is estimated to be 6 persons per mini bus and 1.5 persons per light vehicle.

Construction deliveries are anticipated to peak at 30 light vehicles and 20 heavy vehicles during around month 3 of the construction phase before tapering back to 20 light vehicles and 10 heavy vehicles for the remainder of the construction period. The expected origin of these vehicles is 30% from the west (Blayney and Orange) and 70 % from the east (Bathurst) on the Mid Western Highway. No project related heavy vehicle movements are expected on Vittoria Road or Guyong Road.



OPTION 4 - MID WESTERN HIGHWAY NEW SITE ACCESS INTERSECTION
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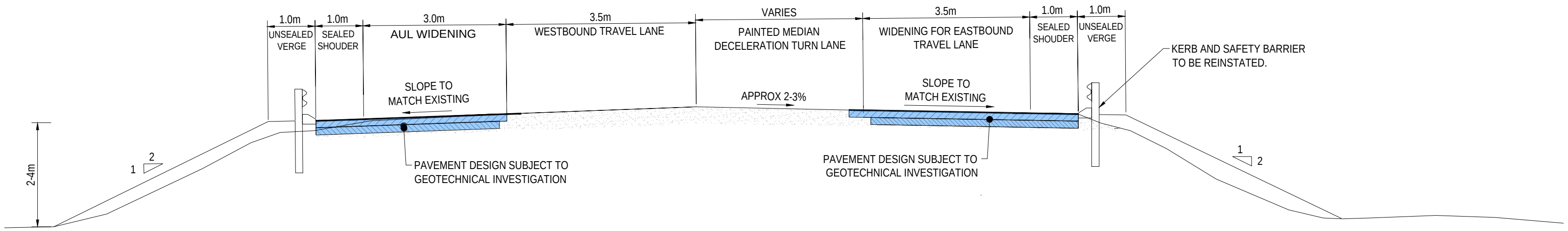

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Concept design – mine access road

McPhillamys Gold Project
Environmental impact statement

Figure 17.2

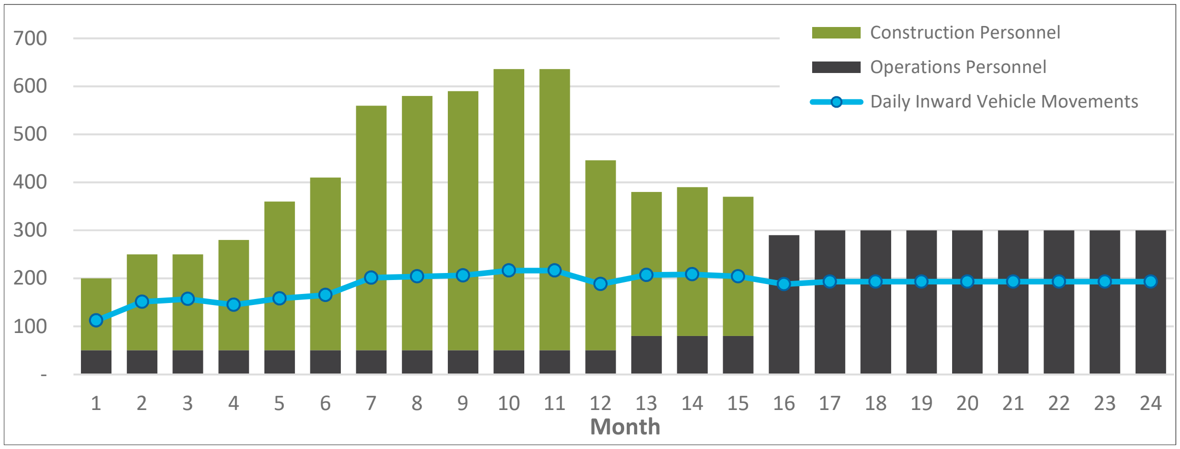

Figure 17.3 Personnel and vehicle movements – months 1 to 24

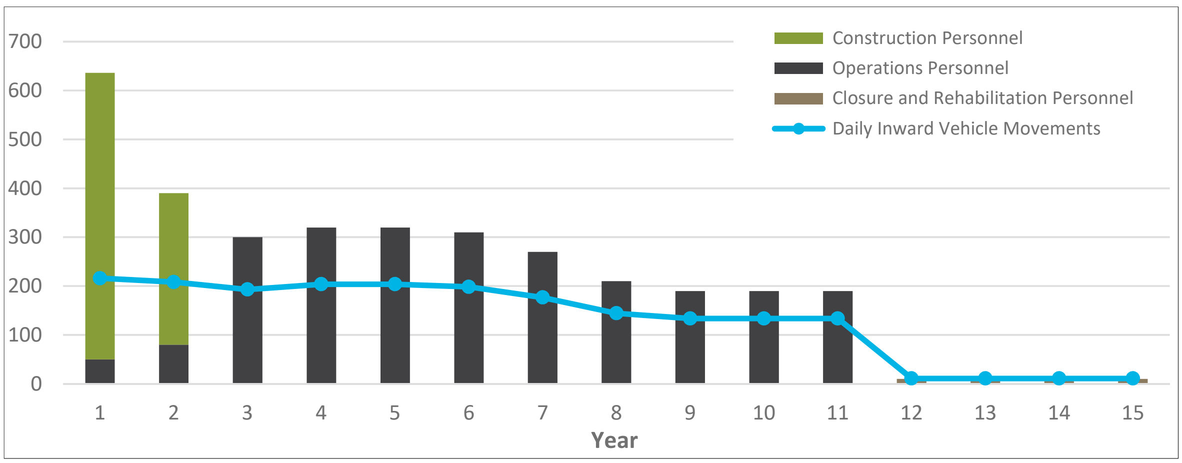

Figure 17.4 Personnel and vehicle movements – years 1 to 15

17.3.3 Traffic related impacts during operation

The projected operations workforce will fluctuate over time, generally reflecting changes in the mine production rate. The annual average operations workforce from Year 2 to Year 11 will be approximately 260 FTE persons. The peak operations workforce of 320 FTE persons is anticipated to occur in around Year 4 and Year 5 and will be associated with the increase in production within the open cut operations at this time.

Mining and processing operations will be undertaken 24 hours per day, 7 days per week, with shifts changing over at around 6:30 am and 6:30 pm. Office based administrative personnel will work a day shift from 7:30 am to 5:30 pm, Monday to Friday.

Operations and administrative personnel are expected to travel to the mine project area in private vehicles during normal operations; however, mini buses may be used during maintenance shutdown periods. Occupancy of these vehicles is estimated to be 1.25 per light vehicle and 6 persons per minibus. As with the case during the construction phase, it has been assumed that 80% of operations and administrative personnel traffic will originate from the west (Blayney and Orange) and 20% will originate from the east (Bathurst).

The mine will operate as a 'drive in drive out operation' meaning all material extracted from the mine project area will be processed on-site and as a result, there will be no heavy vehicle haulage of ore from the project area. The only heavy vehicle movements to and from the project area will be for the delivery of goods. The ratio of heavy vehicles to light vehicles is anticipated to be 3% throughout the mining operation phase.

Deliveries and visitors to the mine project area is estimated to be approximately 30 per day (20 light vehicles and 10 heavy vehicles) during operations. The directional origin of these deliveries and visitors is anticipated to be around 30% from the west (Blayney and Orange) and 70% from the east (Bathurst).

Following the completion of the operation phase, decommissioning and rehabilitation of the mine project area will take place for approximately a further four years with minimal staff, after which it is anticipated the project area will be closed. The anticipated number of workers and associated traffic movements for all three phases is shown in Figure 17.5.

17.3.4 Impacts on the surrounding road network

The TTIA (Constructive Solutions 2019) considered that the surrounding road network has sufficient capacity to accommodate the estimated cumulative background and project related traffic for the 15-year project life.

Forecast background traffic volumes on the surrounding road network were calculated for the 15-year project life. Combining these background traffic volumes with the expected project related traffic results in a minor increase to traffic on the surrounding road network.

As there will be no haulage of ore off site, additional heavy vehicle movements as a result of the mine development are also considered to be minimal.

i Mid Western Highway

Combined background and total project traffic on the Mid Western Highway is shown in Figure 17.5. Project-related traffic represents a maximum of 14% increase above background traffic during Years 1 and 2.

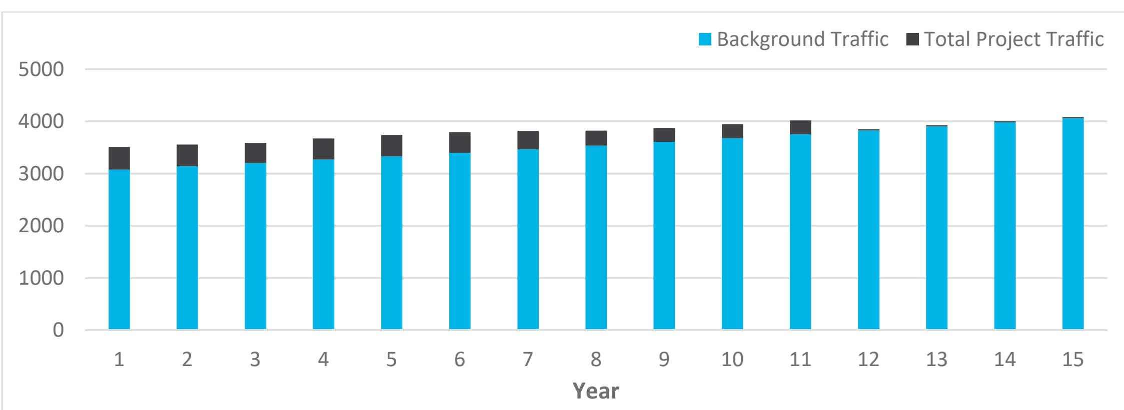

Figure 17.5 Combined traffic - Mid Western Highway

ii Great Western Highway

Project-related traffic on the Great Western Highway will consist of delivery vehicles travelling to and from the project area from Sydney. There may also be a small number of workers using the western end of the highway to commute to work. The total project-related additional vehicle movements on the Great Western Highway will be insignificant compared to the existing background traffic.

iii Guyong and Vittoria Roads

Project-related traffic on Guyong Road and Vittoria Road will only consist of workers travelling to the mine project area who live adjacent to Vittoria Road and Guyong Roads or north-east of the project area. It is estimated that these movements will be approximately 11% of total project-related traffic movements.

To ensure that impacts to Guyong Road and Vittoria Road are minimised, a policy will be implemented by Regis that requires all workers that do not live adjacent to Vittoria Road and Guyong Road, or where an alternative route to the mine project area would take significantly longer, will be required to travel an alternate route to the mine project area. For example, from Orange, an alternative route with a similar travel time is available via Millthorpe Road to Blayney, then along the Mid Western Highway to the new access intersection.

Combined background and project-related traffic for Guyong Road is shown in Figure 17.6. Project-related traffic represents a maximum of 18% increase above background traffic along Guyong Road (during Year 1 of the project).

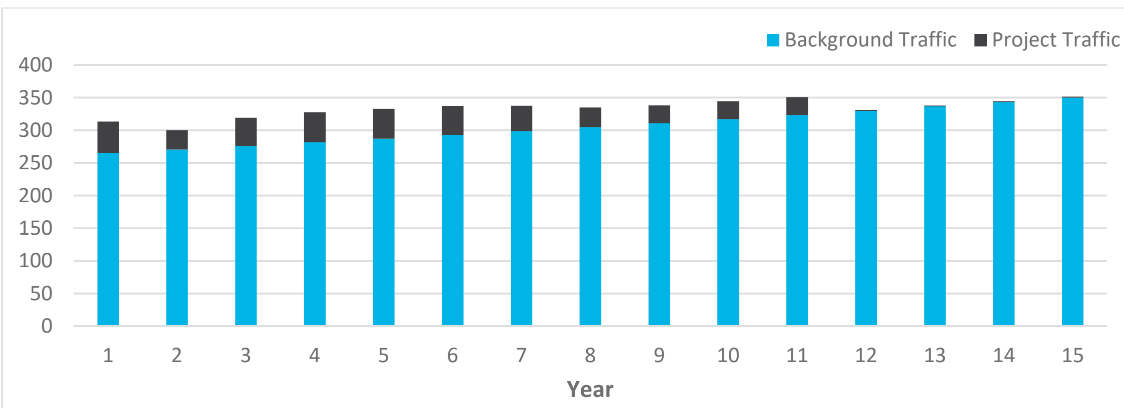

Figure 17.6 Combined traffic - Guyong Road

iv Closure of Dungeon Road

Dungeon Road will be closed to the public at the mine project boundary at the start of construction. The road closure will occur approximately 1,800 m north of the Mid Western Highway at the southern end and approximately 1.2 km south of Vittoria Road at the northern end.

There are two rural properties with dwellings that have access from Dungeon Road at the southern end. The road closure is expected to have no impact on these properties as their access to Blayney or Bathurst via the Mid Western Highway will remain unchanged.

At the northern end of Dungeon Road, Regis has acquired all properties that have access from Dungeon Road. Access for these properties west towards Bathurst will remain unchanged; however, access to the south towards Blayney may be impacted. An alternative route with a similar travel time is available via Vittoria Road and Guyong Road. The alternative route is via sealed roads whereas Dungeon Road is unsealed.

17.3.5 Bus services

As described in 17.2.6, school and passenger buses use the surrounding road network in the vicinity of the mine project area. The mine development is not likely to impact bus services as worker shift changeover times occur before and after school bus morning and afternoon travel times and there are no bus stops on the Mid Western Highway in the vicinity of the new access.

17.3.6 Pedestrian and cyclist activity

The mine development is not likely to impact upon the passage of pedestrians and cyclists, as the new access road will maintain the existing 1 m wide sealed shoulder on both sides of the Mid Western Highway.

17.3.7 Cumulative traffic impacts

Apart from the mine development, there are no known traffic generating developments (or proposed developments) in close proximity to the mine project area.

Significant traffic-generating developments in the wider region include Blayney Cold Storage and Distribution (approximately 1 km east of Blayney on Newbridge Road), a proposed quarry (approximately 3 km north Blayney on Greghamstown Road) and Flyers Creek Windfarm (approximately 15 km west of Blayney). These developments are not located on roads in the vicinity of the mine project area and are therefore not expected to have a significant cumulative impact on the traffic generated by the mine development.

17.4 Management and monitoring

17.4.1 Traffic management plan

A traffic management plan (TMP) will be developed to manage development-related traffic within the mine project area and surrounding road network during the construction and operation phases.

The traffic management plan will include strategies to manage and monitor driver fatigue, road hazards and driver behaviour. The TMP will include a driver code of conduct that encourages considerate and respectful driving. All drivers will receive training in the code during their inductions and failure to comply may result in disciplinary action and potentially also removal from the mine project area.

To reduce the impact of project-related traffic on Vittoria Road and Guyong Road, workers travelling to the mine project area from the Orange and Cabonne LGAs will be encouraged to use an alternative route via Millthorpe Road to Blayney, then along the Mid Western Hwy to the new site access intersection. Workers that do not live adjacent to Vittoria Road and Guyong Road or where an alternative route to the mine project area would take significantly longer, will be required to use an alternate route to the mine project area. Similarly, all contractors and subcontractors based in Orange and Cabonne will be contractually required to use the alternate route to the mine project area. Mini buses used to transport workers will also use this route.

17.4.2 Road maintenance

A truck wheel washing bay will be constructed near the mine site access to eliminate mud tracking onto the Mid Western Highway.

As there will be no haulage of ore from the mine, heavy vehicle impacts will not trigger the requirement for road maintenance contributions.

17.4.3 Oversized vehicle movements

The majority of oversized and over mass vehicle movements will occur during the construction phase and will largely comprise delivery of construction materials, large tyres, plant and parts for the mining fleet. Delivery of large tyres and other parts will also be required during the operations phase, to a lesser extent.

The permitted routes and time restrictions for oversize vehicles, which may include either night-time or daytime deliveries, will be determined in consultation with RMS and relevant local councils and documented in the TMP before construction commences. RMS will decide on the oversize vehicle routes and travel times for the project on a case by case basis in accordance with its policy for oversize vehicle movements within key transport routes.

17.4.4 Local climate conditions

As a safety initiative and subject to approval from RMS, Regis proposes to install fog activated flashing yellow lights, also referred to as wigwags, above warning signs on the Mid Western Highway, in advance of the new site access. These flashing lights would be activated by a fog sensor integrated into the sign which can be programmed to stay on for a period of time after the fog clears. The sign can also be activated during rain.

17.5 Conclusion

Mine development-related traffic will result in a minor increase to traffic volumes on the surrounding road network; however, the impacted roads have sufficient capacity to cater for the combined background traffic and project-related traffic over the 15-year project life.

No significant adverse traffic impacts have been identified as a result of traffic movements to be generated by the mine development during both the construction and operation phases on the local and regional road network based on:

- the road network traffic capacity;
- current intersection traffic operations; or
- the prevailing levels of traffic safety on the road network.

All vehicles will access the mine site via a new access road, which will be designed to safely accommodate project-related traffic volumes. The required intersection with the Mid Western Highway will be designed and constructed with turn treatments to a greater standard than those determined using the Austroads Guide.

A traffic management plan including a drivers' code of conduct will be developed to control project-related traffic movements and driver behaviour within the mine project area and on the surrounding road network.

Chapter 18

Hazard and risk

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18 Hazard and risk

18.1 Introduction

This chapter provides a summary of the preliminary hazard analysis (PHA) prepared for the project by Risk Mentor (2019c), which is provided in full in Appendix R. The chapter also provides a summary of the bushfire risk and hazard assessment (BRHA) prepared by EMM (2019g) (Appendix EE).

Potential geochemical risks associated with the mine development are summarised in Chapter 9 Water resources and discussed in detail in the TSF design report (Appendix D), geochemical characterisation report (Appendix G), surface water assessment (Appendix J) and groundwater assessment (Appendix K). Geochemical risks associated with tailings have been assessed specifically in the TSF risk assessment (refer Chapter 4 and Appendix F).

The PHA assessed the likely risks to public safety, and describes the assessment methods, results and considerations given to measures built into the project design to avoid and minimise impacts to people, property and the environment.

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) requires the consent authority to consider a project's potential to cause hazards or be offensive, including consideration of the location of the development and the way in which it is to be carried out. Where SEPP 33 identifies a development as potentially hazardous and/or offensive, proponents are required to undertake a PHA to determine the level of risk to people, property and the environment.

18.1.1 Assessment requirements and guidelines

The EARs require an assessment of the potential hazards associated with the mine development. The requirements and EIS sections where they are addressed are presented in Table 18.1.

Table 18.1 Hazard related EARs for the mine development

Requirement	Where addressed
Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential geochemical and bushfire risks, and storage, handling, transport and use of any dangerous goods.	This chapter and Appendices R and EE. Geochemical risks addressed in Chapter 9 and Appendices D,F,J & K.

The following guidelines were referenced as part of the PHA:

- *Applying SEPP 33* (DoP 2011a);
- DPE's risk criteria in *Multi Level Risk Assessment* (DoP 2011b);
- Hazardous Industries Planning Advisory Papers (HIPAPs) produced by the Department of Planning (DoP) (now the DPIE), including No. 3 Risk Assessment (DoP 2011c) and No. 6 Hazard Analysis (DoP 2011d); and
- risk assessment guidelines including *AS/NZ ISO 31000:2018 Risk Management – Principles and Guidelines* (Standards Australia 2018), *HB 203:2006 Environmental Risk Management – Principles and Process* (Standards Australia 2006) and *MDG1010 Minerals Industry Safety and Health Risk Management Guideline* (DoTI 2011).

18.2 Identification of hazards and risks

The hazards and risks identified for the project include:

- storage and transport of dangerous goods and materials;
- bushfire risks; and
- geochemical hazards and risks (refer Chapter 9).

18.2.1 Storage and transport of hazardous and dangerous goods and materials

A preliminary screening of hazardous and dangerous goods to be stored and transported as part of the project identified the following materials:

- reagents for ore processing, such as quicklime, sodium cyanide, sodium hydroxide, hydrochloric acid and copper sulphate;
- explosives; and
- fuels and other flammable materials, such as LPG, diesel, oils for lubrication and hydraulic systems.

Table 18.2 summarises the SEPP 33 risk screen summary for storage and transport of potentially hazardous materials. No fumes will be released from the storage or piping of reagents at the mine site. Sodium cyanide and sodium hydroxide will be transported to site in solid form.

Table 18.2 SEPP 33 risk screening summary – storage and transport for the mine development

Material	Storage description	Onsite storage capacity (t)	SEPP 33 storage threshold (t)	Vehicle movements		Minimum quantity per load (t)	Exceed SEPP 33 threshold?	
				Annual	Weekly		Transport	Storage
Reagents for ore processing								
Quicklime	Stored in a purpose-built steel bin 200	200	8	20	2	20	Yes	Yes
Sodium cyanide	Stored in isotainers or flexible intermediate bulk containers (FIBCs)	33	2.5	40	3	20	Yes	Yes
Sodium hydroxide	Stored in bunded tanks	20	8	30	3	20	Yes	Yes
Hydrochloric acid	Stored in bunded tanks	30	8	20	2	20	Yes	Yes
Sodium metabisulphite	Stored in purpose built packaging and bunded tanks	70	N/A	20	2	20	No	No

Table 18.2 SEPP 33 risk screening summary – storage and transport for the mine development

Material	Storage description	Onsite storage	SEPP 33 storage threshold (t)	Vehicle movements		Minimum quantity per	Exceed SEPP 33 threshold?	
Copper sulphate	Stored in purpose built packaging	27	N/A	20	2	20	No	No
Explosives, fuels and other flammable liquids								
Explosives	Stored at a magazine as ammonium nitrate emulsion (ANE)	30	30 (minimum distance of 400 m from other land uses)	50	5	10	Yes	No
LPG	Stored in bullets	14	10	30	3	7	No	Yes
Diesel	Stored in tanks	240	300 (minimum distance of 20 m from other land uses)	50	5	20	Yes	No
Oil and lubricants	Stored in tanks and packaging	20	20 (minimum distance of 7 m from other land uses)	40	3	10	Yes	No

A risk assessment was completed as a component of the PHA which involved identifying scenarios related to the hazardous materials stored on site/transported to site which could pose a risk to public safety or the environment. In general, these scenarios typically involved 'loss' scenarios, which could involve loss of containment of liquids, release of fumes, or detonation of explosives. The scenarios considered were typically 'worst case' which involved conservative assumptions. The scenarios assessed and the residual ranking taking in account controls that would be in place are summarised in Table 18.3. Risks were classified based on an assessment of probability of occurrence and consequence of the scenario occurring. Three levels of risk were considered:

- low risk (tolerable);
- medium risk (as low as reasonably practicable); and
- high risk (intolerable).

Table 18.3 Mine development - risk ranking of potential scenarios

Scenario	Risk ranking
Generation of HCN from the holdings of NaCN	Low
Vehicle transporting reagents is involved in an accident	Medium
Detonation of explosives in onsite magazine	Low
Detonation during transportation of explosives	Medium
Ignition of fuels and other flammable materials on site	Low
Ignition of fuels and other flammable materials during transportation	Medium

In the presence of control measures, all scenarios evaluated were low or medium risk, accordingly the PHA determined that the project does not represent an offensive or hazardous development (Risk Mentor 2019c).

18.2.2 Bushfire risks

A Bushfire Hazard Assessment (BFHA) was completed for the project by EMM (2019g), which is provided in full in Appendix EE and summarised below. The BFHA provides an assessment of potential hazards associated with bushfire and recommends mitigation measures, in consideration of the NSW *Rural Fires Act 1977* and *Planning for Bushfire Protection* (RFS 2006 and 2018) (PBP).

The mine project area is within the Blayney LGA, which has been rated by the NSW Rural Fire Service (RFS) as having a fire danger index (FDI) of 80. The FDI rating is used to inform bushfire behaviour based upon broad characteristics of the LGA and is one factor considered when determining bushfire risk (EMM 2019). The eastern boundary of the mine project area and Vittoria State Forest, north-east of the project area, are mapped as bushfire prone (Figure 18.1).

The project area is in the Canobolas Bushfire Management Committee (BFMC) area, which experiences north-westerly winds, high daytime temperatures, low humidity and dry lightning storms during the bushfire season (October to March). Existing sources of ignition of unplanned fires in the Canobolas BFMC include (EMM 2019g):

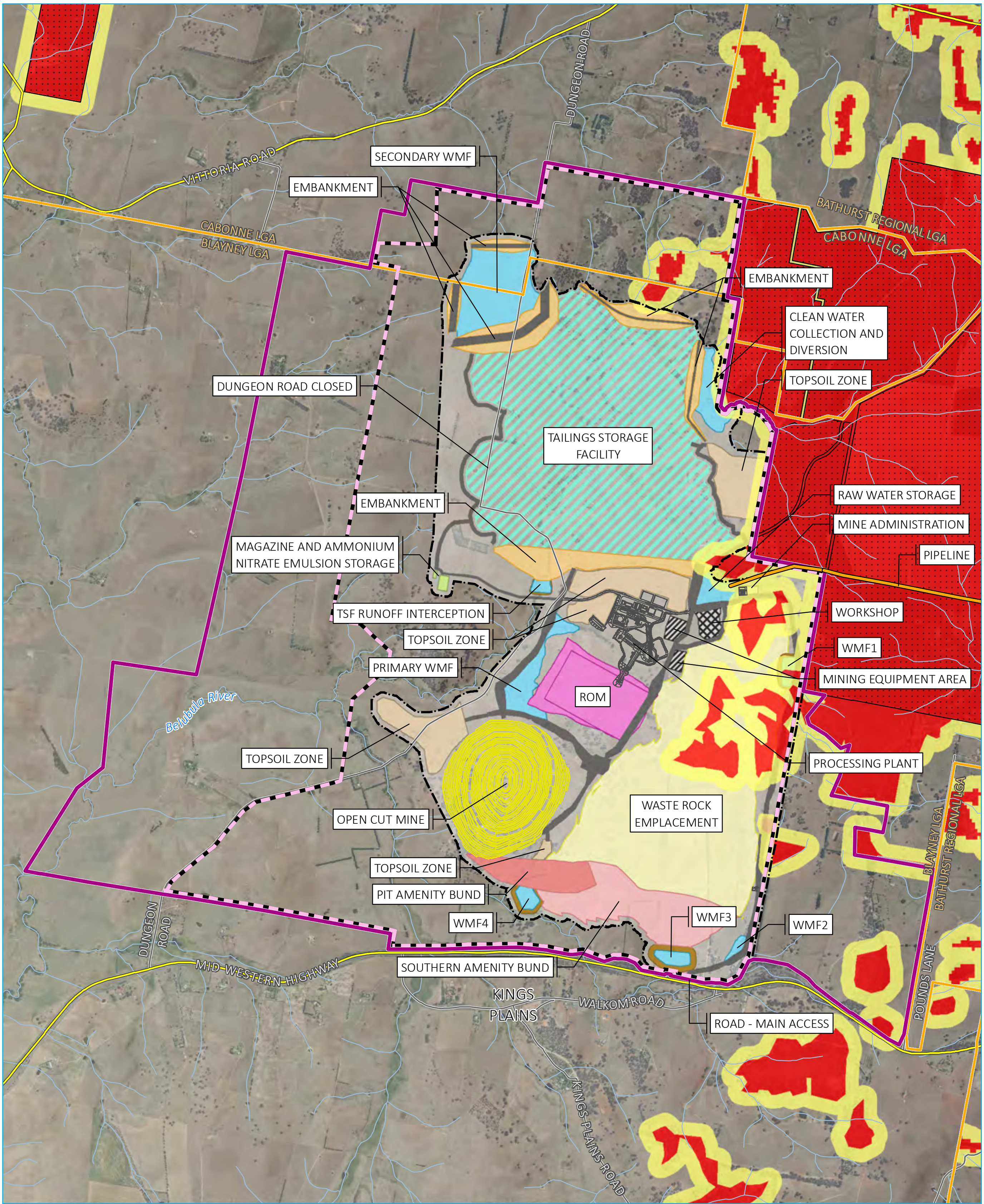
- lightning strikes;
- electrical infrastructure failures;
- arson;
- machinery and vehicles; and
- welding and grinding activities.

Other relevant factors in considering bushfire risk are vegetation characteristics and slope. The mine project area consists of native vegetation which aligns with woodland, forest, grassland and freshwater wetland vegetation formations. Of these, the grassland vegetation classification is the most prevalent of the mapped vegetation. The landscape is gently undulating with some areas of steeper slopes. The steeper slopes are considered to be a bushfire hazard, as they can accelerate the rate at which a bushfire spreads.

Bushfires originating in areas outside of the mine project area have the potential to threaten or damage infrastructure at the mine site, which could impact the safety of staff and contractors on site, public safety and the environment within and surrounding the project area.

In addition, the project could represent a risk to the surrounding environment associated with potential ignition sources from site operations. Potential sources of ignition that could ignite a bushfire at the mine site include:

- diesel generators;
- storage and transportation of flammable liquids (eg fuel storage) and explosives;
- vehicle and machine movement over long grass;
- sparks generated from hot works (eg welders and grinders);
- human error, such as non-compliance of hot works procedures or incorrect disposal of cigarette butts;
- overhead powerlines; and
- blast activities.



Source: EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); RFS (2015); ELVIS (2014)

0 1 2 km

GDA 1994 MGA Zone 55

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KEY

Project application area

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Bushfire prone land

- Vegetation Category 1
- Vegetation Category 2
- Buffer

Project general arrangement

- Plant layout
- Road
- Water management facility (WMF)
- Sediment basin structure

Existing environment

- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest
- Local government area

Bushfire mapping - mine development

McPhillamys Gold Project
Environmental impact statement
Figure 18.1

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18.3 Management and mitigation measures

18.3.1 Storage, transportation and use of hazardous materials management measures

Regis will prepare a hazardous materials management plan which will describe the measures that will be implemented to ensure the safe handling, storage and transportation of hazardous materials used onsite. This plan will also document appropriate emergency procedures.

The potentially hazardous materials will be transported to the mine site by road in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (NTC 2018). Regis will use a suitably qualified supplier for the delivery of potentially hazardous materials to the mine site. Site specific measures relevant to the transport of all potentially hazardous materials will be included in individual supply contractors and implemented by onsite personnel.

Explosives will be stored in a magazine facility designed to meet the separation and design requirements in *AS2187.2 2006 Explosives – Storage, Transport and Use*. In addition, the following measures will be implemented during the transportation of explosives (Risk Mentor 2019):

- containers will be protected against static electricity, suitably robust and adequately labelled; and
- explosives will be appropriately separated during transportation and threshold quantities maintained.

All potentially hazardous materials will be stored onsite away from disturbance boundaries to prevent any impact to members of the public. The magazine is located more than 2,200 m from the nearest sensitive receiver (R76) and over 1,000 m from the open cut, processing plant and administration areas. The diesel and LPG storage locations will be located separately to prevent unwanted interaction. They will also be located away from ignition sources, including machinery and vegetation.

Sodium cyanide will be stored in accordance with the International Cyanide Code. The compound will be dry, bunded, locked and remote from any flammable materials. Liquid form sodium cyanide will be stored in bunded tanks and rated and labelled pipelines.

18.3.2 Bushfire management measures

Management measures will be used to prevent a fire or explosion in the infrastructure areas initiating a bushfire; reduce the severity of an existing bushfire through fire breaks and by fighting fires with mine resources. With these measures in place, the mine development is unlikely to be damaged by, initiate or contribute to the severity of a bushfire. Further, the mine development will strengthen community bushfire-fighting capabilities thus decreasing the overall bushfire risk in the area.

The primary management measures for bushfire prevention and protection during construction, operation and decommissioning of the project include:

- the provision of clear separation between structures and bushfire hazards in the form of fuel reduced asset protection zones (APZs) and/or defendable space;
- appropriate access and egress for staff, contractors, visitors and emergency services;
- adequate water supply;
- suitable location of services and other infrastructure that pose potential ignition risk;

- suitable construction standards and design of buildings;
- promotion of bushfire awareness amongst the workforce; and
- suitable management plans for the provision and maintenance of mitigation measures as well as for appropriate emergency response.

A bushfire management plan (BMP) will be prepared and implemented for construction, operation and decommissioning, which will govern the implementation of the above listed management measures. This will also take into account recommendations of the BPB (RFS 2016 and 2018). A bushfire specific emergency response plan (ERP) would also be prepared for each of the project stages, in consideration of *A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan* (RFS 2014) and *Australian Standard 3745-2010 Planning for emergencies in facilities* (Standards Australia 2010).

18.4 Conclusion

The hazards and risks identified for the project include storage and transport of dangerous goods and materials; bushfire risks; and geochemical hazards and risks (refer Chapter 9).

The PHA found that the project does not represent an offensive or hazardous development. There are no potential loss scenarios with offsite consequences. Transport of hazardous goods to the mine site, while posing a conceivable issue for off site members of the public, is expected to be adequately addressed through strict conformance with the Australian Code for the transport of Dangerous Goods. Regis will commit to the preparation of hazardous materials management plan which will describe the measures that will be implemented to ensure the safe handling, storage and transportation of hazardous materials used onsite. This plan will also document appropriate emergency procedures.

With the implementation of management measures identified in Section 18.3.2, the risk of a fire on Regis owned land initiating a bushfire which moves onto adjacent properties will be effectively controlled.

Chapter 19

Visual amenity

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19 Visual amenity

19.1 Introduction

This chapter provides a summary of the visual impact assessment (VIA) prepared by Visual Planning and Assessment (VPA) (2019) for the proposed mine development. The VIA is provided in full in Appendix S.

The EARs require and assessment of the mine development's potential impact on visual amenity. The specific requirements and sections of the EIS that address them are provided in Table 19.1.

Table 19.1 Visual amenity related EARs for the mine development

Requirement	Where addressed
Visual – including an assessment of: – the likely visual impacts of the development on private land in the vicinity of the development and key vantage points in the public domain, paying particular attention to any temporary and permanent modification of the landscape (eg overburden dumps, bunds, tailings facilities), and – the lighting impacts of the development.	This chapter and Appendix S

This visual impact assessment was also prepared following the appropriate guidelines, policies and industry requirements, and following consultation with stakeholders including community members and relevant government agencies.

Guidelines and policies referenced are as follows:

- Landscape Institute and Institute of Environmental Management & Assessment (2013) - *Guidelines for Landscape and Visual Impact Assessment* 3rd Edition;
- AILA Queensland Regional Landscape Group (2017) - Landscape and Visual Assessment – AILA Guidance Note for Queensland (2017); and
- Australian Standards (AS 4282 – 1997): Control of the Obtrusive effects of Outdoor Lighting.

19.2 Methodology

The method of the visual amenity assessment included assessment of the following factors:

- visual environment – consideration of the landscape setting and viewing locations;
- visual effect including contrast and integration – a measure of the level of visual contrast and integration of the mine development with the existing landscape;
- visual sensitivity – how critically a change to the existing landscape may be when viewed at different land use areas and stakeholders at varying distances;
- visual impacts – consideration of the number and type of viewers and their potential sensitivity to changes to the visual landscape;

- cumulative impacts – the combined visual impact of the mine development with existing or future development within a prescribed distance from the mine project area; and
- lighting – consideration of the direct, diffuse and night lighting resulting from the mine development in consideration of AS/NZS:4282:2019 Control of the Obtrusive Effects of Outdoor Lighting.

19.3 Existing environment

The VIA defines the area of the primary visual catchment (PVC) within which the mine project area is located. The PVC is illustrated in Figure 19.1 and covers an area of approximately 232 km. The western slopes of the Great Dividing Range form the eastern section of that perimeter. Within the PVC, the mine project area is located within a predominantly rural setting, with cattle grazing being the predominant land use. The project area includes dispersed residential development incorporating both small and large rural holdings. Other land uses surrounding the mine project area include:

- Vittoria State Forest adjoining the eastern boundary of the project area;
- Mid Western Highway adjoining the southern boundary of the project area;
- Guyong Road to the far west of the project area;
- Vittoria Road to the far north of the project area; and
- Settlement of Kings Plains immediately south of the project area.

Topography surrounding the mine project area typically ranges from 900 m AHD and 1,000 m AHD with moderate to gentle slopes down to open valleys.

19.3.1 Sensitive receivers within primary visual catchment

Sensitive receivers in the PVC include residences, tourist and recreation areas and roads.

i Rural residences

The rural residences located to the south and south-west of the mine project area are likely to experience visual impact. The location of residences within 2 km of the mine development is shown in Figure 19.1.

ii Kings Plains settlement

The Kings Plains settlement has an estimated resident population of 45 people and is approximately 1.2 km from the face of the open cut pit area and approximately 0.5 km to the nearest mine lease application area boundary. Residences within Kings Plains settlement have variable views into the mine project area.

iii Tourist/recreation areas

The following tourist and recreation areas may experience visual impact:

- Blayney township;
- Billy Soo rest area – located on the northern side of the Mid Western Highway. It is approximately 6.4 km to the mine project area and 3.7 km to the nearest mine lease application area boundary;

- Church Hill Rotary lookout – located on the north side of Blayney. There are broad views to the north, east and south across the PVC. The lookout is approximately 7.4 km to the mine project area and 4.6 km to the nearest mine lease application area boundary;
- Heritage Park – located in the low lying south-west edge of Blayney township. It contains a community performance space, public facilities and play areas. The park is approximately 8.0 km to the mine project area and 5.7 km to the nearest mine lease application area boundary; and
- Vittoria State Forest – located to the east and north-east of the mine project area. The forest is used by recreational 4WD and trail bike enthusiasts.

iv Road network

Highways used as part of designated tourist routes have a high to low sensitivity, dependent upon distance from a view. The Mid Western Highway runs generally north-east to south-west connecting Bathurst to Cowra and services rural destinations further west and south via Blayney. It bisects the PVC centrally from east to west directly south of the mine project area.

The Mitchell Highway connects Bathurst to Orange as part of the National Highway A32 corridor, which stretches from Sydney to Adelaide via Dubbo and Broken Hill. It crosses the PVC from east to west, to the north of the mine project area.

v Blayney township

Blayney has an estimated resident population of 2,963 people and is approximately 7.5 km to the mine project area pit area and approximately 4.9 m to the mine lease application area boundary. The town's elevated locations on its western perimeter have distant views around the PVC.

vi Rural areas

The predominant land use within the PVC is rural production land, including, grazing sheep and cattle.

19.3.2 View sectors and visual sensitivity

To assist in the evaluation of the visibility of the various elements of the project the primary visual catchment (PVC) was divided into the following view sectors as illustrated on Figure 19.2.

- northern view sector;
- eastern view sector;
- southern view sector; and
- western view sector.

The visual sensitivities of the respective view sectors are summarised below.

i Northern view sector

The northern view sector is dominated by low sensitivity rural lands, but includes numerous rural residences, the Mitchell Highway, Vittoria-Millthorpe Road, Vittoria State Forest and the East Guyong Quarry.

Most of the rural residences are surrounded by gardens or are screened by local topography, meaning that direct views to the project are unlikely. However, these residences may experience some skyglow created by the nightly project activities. Views from residences closer than 7.5 km would have a high sensitivity.

Localised low ridgelines run parallel to the south of the Mitchell Highway limiting views south into the mine project area. Roadside vegetation between the eastern edge of the PVC and the turn off to Millthorpe-Vittoria Road also screen views to the south. Parts of Vittoria State Forest screen views south-west from the highway near mine lease application area boundary.

ii Eastern view sector

The eastern view sector largely comprises grazing lands and state forest, with scattered rural residences mainly to the west and south of the mine project area within the view sector. There is one commercial activity, the Beekeepers Inn on the Mitchell Highway. Views from fire trails within the state forest used for fire management and recreation would have high to moderate sensitivity.

Views to the mine project area from the Beekeepers Inn are contained by local topography and the dense screening of the Vittoria State Forest between the location and the mine project area northern boundary. Any views from this location would have high visual sensitivity.

There are several rural residences in this sector; those within the project area are already mine owned. Outside the mine project area, the residences that are within 7.5 km of the project area would have a high visual sensitivity. Some private residences would be screened from the project area by Vittoria State Forest and local topography.

Dungeon Road lies within this sector and is a rural access track to properties around and within the project area. Some of this road would be incorporated into the mine development and would have low visual sensitivity.

iii Southern view sector

There are several rural residences in this sector. Residences that are within 7.5 km of the project area (all residences) will have a high visual sensitivity. In addition, the land surrounding these residences has high visual sensitivity as it is part of the amenity experience of the resident's lifestyle. Their enjoyment / lifestyle includes the activities and expansive views experienced at various locations within their properties.

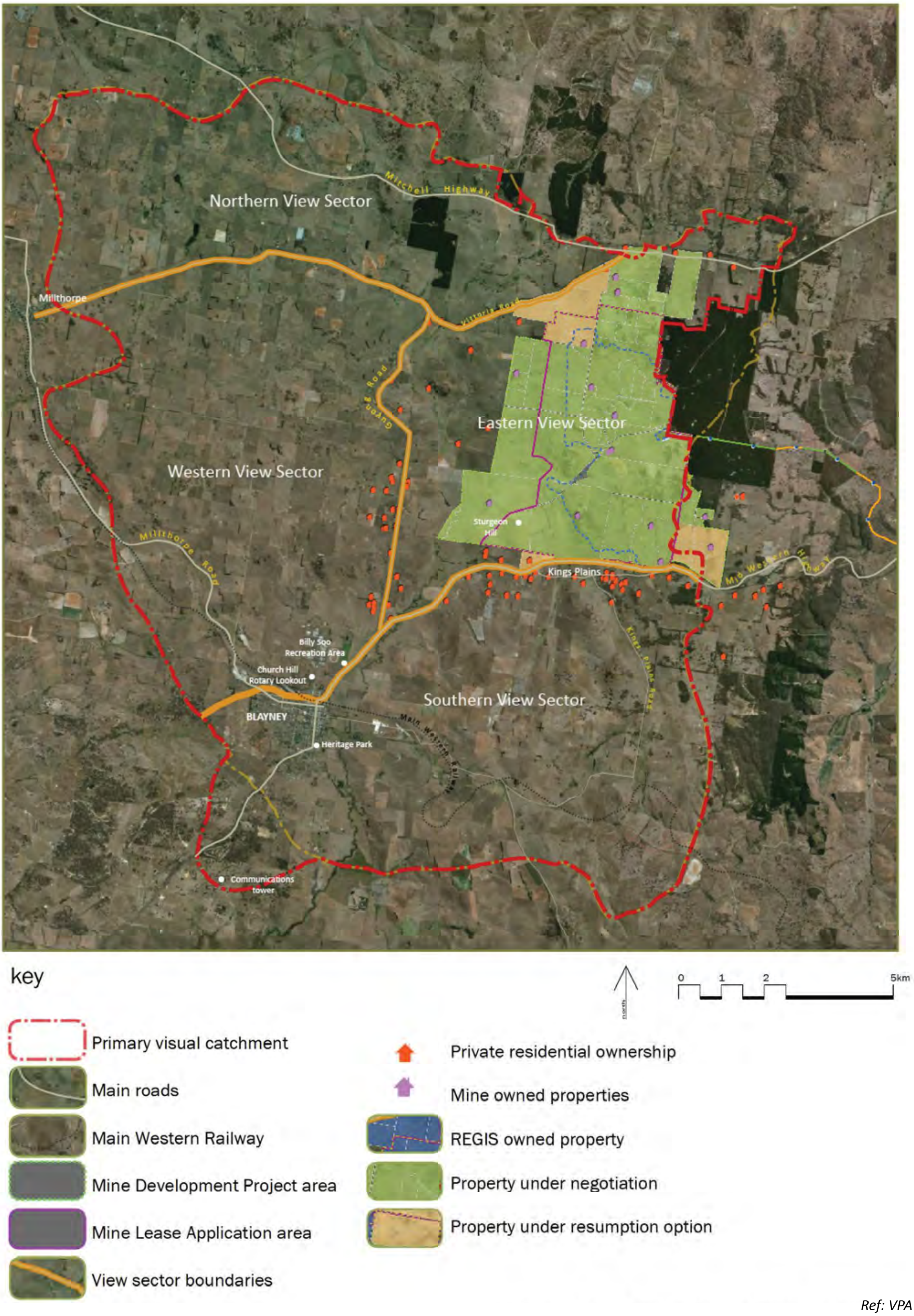
The highway runs directly along the southern project area boundary. Views into the project area are limited to a few localised positions on the highway within a 3 km stretch directly adjacent the project area. Local topographic features and vegetation provide screening along most viewpoints from both the east and west travel directions.

Locations where the mine development will be highly visible include the elevated road crest at the eastern extent of the PVC views and the stretch of highway adjacent to the Kings Plains locality turnoff.

iv Western view sector

There are a number of rural residences in this sector. Most are scattered along the Guyong Road ridge north of the Mid Western Highway. Residential properties in this context may have views of the project area along the western boundary.

Views from Blayney are generally limited by topography and intervening vegetation. The majority of the township is low lying along the Belubula River flood plain. The more elevated areas of the township have limited distant views to the project area. Any views within Blayney less than 7.5 km (eastern perimeter) will have high visual sensitivity. Any views from the western elevated residences that are greater than 7.5 km, accordingly, will have moderate visual sensitivity.



Ref: VPA 2019

Primary visual catchment – mine development

McPhillamys Gold Project
Environmental impact statement

Figure 19.1

key

0 1 2 5km

Primary visual catchment

Roads

Main Western Railway

Mine Development Project area

Photomontage view locations

Ref: VPA 2019

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View sectors and photomontages locations – mine development

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Environmental impact statement

Figure 19.2

19.4 Visual effect

Visual effect is a measure of the visual contrast and integration of the mine development with the existing landscape. Visual effect is also based upon the percentage of the total primary view zone (PVZ) occupied by the mine development. This was assessed for five viewpoint locations within the north, eastern, southern and western view sectors (refer Figure 19.2). Locations were selected to illustrate a range of typical views and worst case scenarios as seen from the various view locations Photomontages were prepared to illustrate the view from these locations during construction and operation of the mine development and are also provided below.

19.4.1 VP1 – Guyong Road, Blayney

VP1 is located in the western view sector and is representative of those visual effects to be expected when viewed from residences and their surrounding lands, close to this view location on Guyong Road. It also reflects the short duration views from vehicles travelling along Guyong Road. The existing view of the project area from this viewpoint and an overview of the anticipated visual effects of the project on VP1 over the project life are depicted in Figure 19.3 to Figure 19.4.

i During project life

Early in the project life (prior to Year 2), vegetation clearing, topsoil stripping and stockpiling and creation of new landforms such as the ROM Pad and haul roads will be visible from VP1. There will be high level contrast in colour and texture as the existing colours are replaced by the higher contrasting exposed earth.

New landforms will have low contrast in shape and form to existing setting of undulating rural hills and low ridgelines within this view. However, colour contrast will be high until grass rehabilitation is achieved. Construction of infrastructure components will form a minor part of this new view, though will be partially screened by new landforms along the western face.

From Year 2 to Year 10 progressive rehabilitation of the ROM Pad, waste emplacement and topsoil stockpile areas will reduce visual contrasts with existing setting. There will be some contrast created by the elevated horizon line of the waste rock emplacement rising above the existing horizon. The horizontal linear scale and regular form of new embankments and newly grassed surfaces also contrast with the existing setting. Views to infrastructure components and ancillary facilities will have moderate contrast with existing rural setting; distance from these components from this view location will limit the extent of visual effects in this context.

Direct lighting will be visible up to Year 2 where vehicles and earth moving equipment move around the mine project area. Direct lighting may continue to be visible from this viewpoint on higher elevations on the waste rock emplacement whilst waste rock material continues to be deposited to upper levels over the life of the project. Sky glow effects from the project area will occupy the centre of this view and create moderate to high contrast to existing dark sky character of the existing setting.

ii Final landform

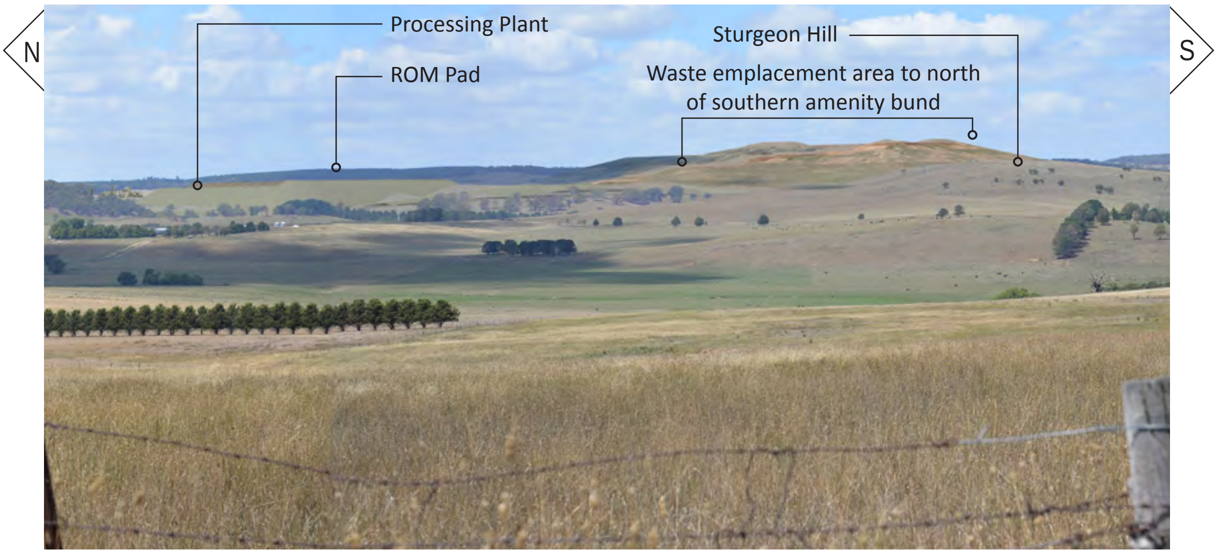
The final landform, now with well established grass cover and new tree planting, would have reduced visual contrast. Micro-relief of the final landform ridgeline of the waste rock emplacement area will increase visual integration with the existing topography. Established rehabilitation of new landforms will have low contrast to the surrounding settings.

Long term visual effects are reduced significantly when the established planting patterns further compliment the microtopographic landforms and grassing.

VP 1: Garvey Roadside - Guyong Road

Existing view

View east towards Mine Project western boundary - Year 2



View east towards Mine Project western boundary - Year 4

Ref. VPA 2019

VP 1: Garvey Roadside - Guyong Road

View east towards Mine Project western boundary - Year 8

Micro-relief of landform creates a well integrated profile within rural setting. Established rehabilitation reduces has reduced visual contrast.

View east towards Mine Project western boundary - Final Landform

Vegetation patterns and final landform profile create a view that is well integrated with the surrounding rural setting.

Ref. VPA 2019

19.4.2 VP2 – Mid Western Highway travelling east

This view is from the highway travelling east. It is representative of the short duration views from the highway whilst passing the project area southern face. Views onto this face are limited to an approximately 3.2 km long stretch of the highway. Outside this section, such views are screened by intervening topography such as Sturgeon Hill or filtered by roadside vegetation. The existing view of the project area from this viewpoint and an overview of the anticipated visual effects of the project on VP2 over the project life are depicted in Figure 19.5 to Figure 19.6.

i During project life

Initially there will be vegetation clearing, topsoil stripping, stockpiling and creation of new landforms. By Year 2 the advancement of the waste rock emplacement will exceed the previous existing ridgeline in elevation. Integration with setting is reduced by contrasting exposed earth and new man-made large scale landforms. At Year 2, the faces of the southern and pit amenity bunds and the waste rock emplacement are in centre view, seen as contrasting bands of exposed earth and rock and rehabilitation (hydromulching and grassing). This will begin to lower visual contrasts. At Years 4 and 8, the southern amenity bund face will have some rehabilitation (grassing and early stages of woodland establishment) lowering visual contrast for those parts of the south face.

ii Final landform

The final landform, now with well established grass cover and new tree planting, has reduced visual contrast. Form is consistent with surrounding undulating rural character; scale of new landform is larger than existing setting but similar to landscape character in this rural setting. In the long term visual contrast will be very low as tree patterns and grass cover textures mature to resemble surrounding landscape patterns. Visual integration will now be high with minimal discernible differences to surrounding landscape character of rolling hills.

19.4.3 VP3 – Residence on Walkom Road (west) Kings Plains

VP3 is representative of residential or locality views at lower elevations along Walkom Road / Kings Plains locality south of the Mid Western Highway and the project boundary. The tree covered hill in centre view is the south face of the open cut mine which is the focal point of this view from this residence. A low intervening ridgeline between this view and the southern boundary of the mine project area screens existing views of elevated slopes north of the highway within the mine project area. The existing view of the project area from this viewpoint and an overview of the anticipated visual effects of the project on VP3 over the project life are depicted in Figure 19.7 to Figure 19.8.

i During project life

Up to Year 2, there will be vegetation clearing, topsoil stripping and stockpiling and mine development and mine operational activities which will remove the top of the open cut hill (McPhillamys hill). VP3 will have views of the pit amenity bund being constructed over Year 1 and of the southern amenity bund being constructed up to the end of Year 4. There will be high level contrast in colour and texture as the existing colours are replaced by the higher contrasting exposed earth. New landforms (amenity bunds) will have high contrast in scale and form and low integration with existing setting of undulating rural hills and low ridgelines within this view. At Year 4 and Year 8 the southern faces of the southern amenity bund and the pit amenity bund show progressive rehabilitation (grassing and early stages of woodland establishment) lowering visual contrast.

Direct lighting will be visible early in the mine life and potentially up to Year 4 where vehicles and earth moving equipment move around the project area and prior to completion of visual amenity bunds, after which operational lighting from the infrastructure and ancillary facilities will be screened.

Sky glow effects from the project area will occupy this view at night and create moderate to high contrast to existing dark sky character of the existing setting.

VP 2: Mid Western Highway west

Existing view

Year 2

Year 4

Ref. VPA 2019

VP 2: Mid Western Highway west

Year 8

Final Landform

Vegetation patterns and final landform profile create a view that is well integrated with the surrounding rural setting.

Ref. VPA 2019

VP 3: Kings Plains Residence

Ingledoon Hill

Existing view

Establishment of pit amenity bund adjacent the open cut pit. Visual effect is created by change of vegetation patenrns and natural profile.

Development of southern amenity bund with unrehabilitated areas and changes to vegetation patterns creating visual constrast with surrounding setting.

Year 2

The pit amenity bund will initially be seeded with introduced grass species to provide erosion protection and to improve visual amenity.

Southern amenity bund has developed to final height. Early rehabilitation of lower slopes begins to reduce visual contrast.

Year 4

Ref. VPA 2019

VP 3: Kings Plains Residence

Rehabilitation of grassing and vegetation to pit amenity bund reduces visual contrast of lower slopes.

Upper slopes have levels of contrast in colour and texture with surrounding setting. Micro-relief implemented to upper profile of waste rock emplacement contributes to improved visual integration.

Year 8

Southern amenity bund completed. Rehabilitation of grassing and vegetation to slopes reduces visual contrast. Micro-relief implemented to upper profile of waste rock emplacement contributes to improved visual integration.

The pit amenity bund has been regraded to achieve lower height landform and improve visual amenity.

Final landform

Ref. VPA 2019

ii Final landform

The final landform, now with well established grass cover and new tree planting, has reduced visual contrast. Form is consistent with surrounding undulating rural character; scale of new landform is larger than existing setting but similar to landscape character in this rural setting. Long term visual effects are reduced significantly when the established planting patterns further compliment the microtopographic landforms and grassing***.***

19.4.4 VP4 – Residence on Walkom Road (west) Kings Plains

Viewpoint VP4 is representative of residential or locality views at higher elevations along Walkom Road / Kings Plains area directly south of the project boundary. Views from this residence reflect open views to the north from some more elevated residences within Kings Plains. Existing primary views include undulating rural grazing lands, stands of woodland and other Kings Plains residences and property. The linear fence line planting along hill/ridgeline in centre right of view is indicative of extent of proposed waste rock emplacement. The existing view of the project area from this viewpoint and an overview of the anticipated visual effects of the project on VP4 over the project life are depicted in Figure 19.9 to Figure 19.10.

i During project life

The visual effects of the project occupy a significant percentage of the primary view zone from VP4. This viewpoint will have views of the pit amenity bund being constructed over Year 1 and of the southern amenity bund being constructed up to the end of Year 4. There will be high level contrast in colour and texture as the existing colours are replaced by the higher contrasting exposed earth. New landforms (amenity bunds) will have high contrast in scale and form and low integration with existing setting of undulating rural hills and low ridgelines within this view. Integration with setting is reduced by contrasting exposed earth and new man-made large scale landforms. Haul roads and truck movements will be visible until pit amenity bund and southern amenity bund achieve final finished levels by the end of Year 1 and Year 4 respectively.

At Year 4 and Year 8 the southern faces of the southern amenity bund and the pit amenity bund will have progressive rehabilitation (grassing and early stages of woodland establishment) lowering visual contrast.

Direct lighting will be visible up to Year 4 where vehicles and earth moving equipment move around the project area and prior to completion of visual amenity bunds although this will be mitigated following completion of the pit amenity by the end of Year 1. Operational lighting from the infrastructure and ancillary facilities will be screened by the amenity bunds and waste rock emplacement. Sky glow effects from the project area will occupy this view at night and create moderate to high contrast to existing dark sky character of the existing setting.

ii Final landform

The pit amenity bund will be regraded to lower the height of the landform to ensure the long term stability of the landform and improve visual amenity.

The final landform, now with well established grass cover and new tree planting, has reduced visual contrast. Form is consistent with surrounding undulating rural character; scale of new landform is larger than existing setting but similar to landscape character in this rural setting. In the long term visual contrast will be very low as tree patterns and grass cover textures mature to resemble surrounding landscape patterns. Visual integration will now be high with minimal discernible differences to surrounding landscape character of rolling hills.

VP 4: Kings Plains Residence

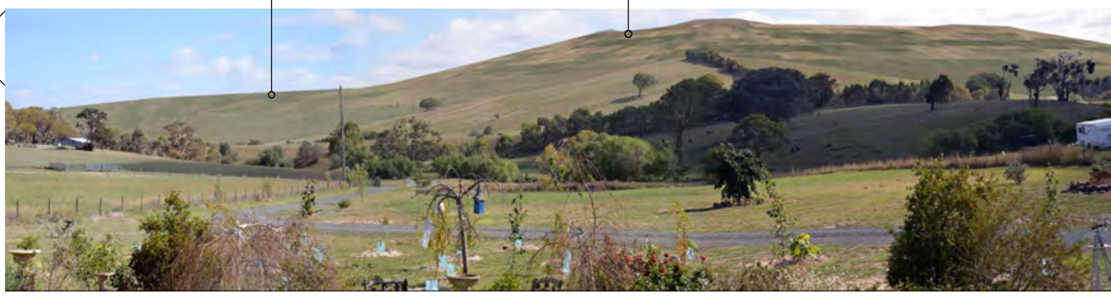
Existing view

Development of southern amenity bund and pit bund. Contrast in colours and textures creates high level of visual contrast during this stage.

Year 2

Pit amenity bund completed. Rehabilitation of grassing and vegetation to slopes reduces visual contrast.

Micro-relief implemented to upper profile of waste rock emplacement contributes to improved visual integration.



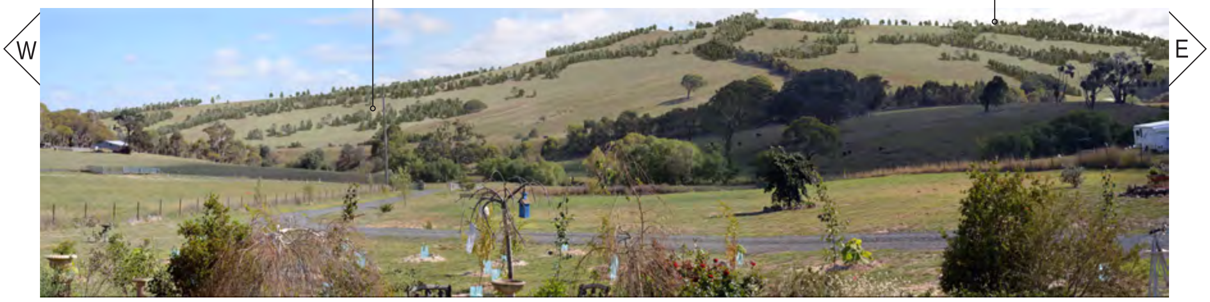
Year 4

Ref. VPA 2019

Rehabilitation grassing and vegetation is well established, improving visual integration and reducing contrast.

Year 8

Established tree planting with patterns emulating existing landscape vegetation patterns of woodland and hedge rows. Landform is larger in scale but well integrated with surrounding rural setting.



Final Landform

Ref. VPA 2019

Photomontage VP4 - Year 8 to Final landform

McPhillamys Gold Project
Environmental impact statement

Figure 19.10

19.4.5 VP5 – Mid Western Highway travelling west

This view is from the highway travelling west near the eastern extent of the PVC. It represents the short duration views from the highway whilst passing the mine project area southern face looking towards significant topographic features in the distance such as Mt Conobolas centre left of view. Thick plantation pine forests to the north of highway limit view angles at this location. Views will open out along an approximately 3.2 km long stretch of the highway. Outside this section, such views are screened by intervening roadside vegetation.

The existing view of the project area from this viewpoint and an overview of the anticipated visual effects of the project on VP5 over the project life are depicted in Figure 19.11 to Figure 19.12.

i During project life

During construction/ development of amenity bunds (pit amenity bund by year 1 and southern amenity bund by Year 4 there will be vegetation clearing on hill slopes and open pastures, topsoil stripping and stockpiling and creation of new landforms (WMF embankments, amenity bunds and waste emplacement area). The advancement of the waste rock emplacement will exceed the previous existing ridgeline in elevation between open cut mine and eastern extent of waste rock emplacement.

At Year 2, the faces of the amenity bunds and waste rock emplacement are right of the highway, seen as contrasting bands of exposed earth and rock and visible haul roads. The sides of WMF embankments can also be seen as contrast earth material at the tow of the slope.

From Year 2 to Year 8, the southern amenity bund will have progressive rehabilitation (grassing and vegetation planting) lowering visual contrast. By Year 4, following completion of the southern amenity bund, the waste emplacement will be screened from this view location. By Year 8, a significant level of rehabilitation should be achieved, lowering visual contrast for the south face.

There will be no visibility of haul trucks exiting the open cut pit after development of the pit amenity bund. By Year 4, following completion of the southern amenity bund, there will be no visibility of haul trucks on the waste rock emplacement.

ii Final landform

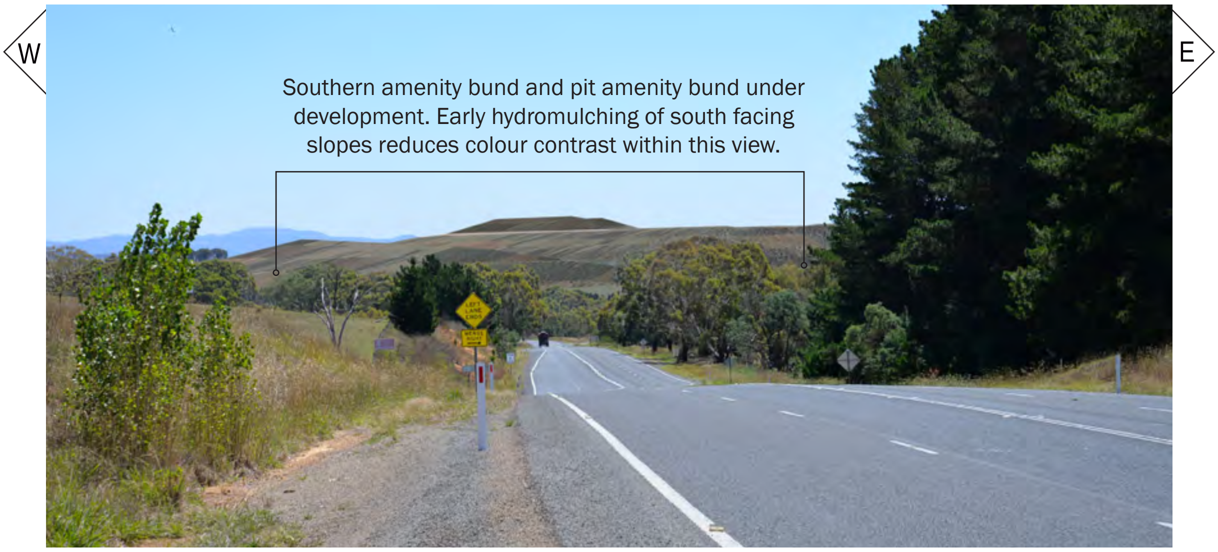
The pit amenity bund will be regraded to lower the height of the landform to ensure the long term stability of the final landform and improve visual amenity.

The final landform, now with well established grass cover and tree planting, has reduced visual contrast. Form is consistent with surrounding undulating rural character; scale of new landform is larger than existing setting but similar to landscape character in this rural setting.

Long term visual effects are reduced significantly when the established planting patterns further compliment the microtopographic landforms and grassing.

VP5: Mid Western Highway - East

Existing view



Year 2

Year 4

Ref. VPA 2019

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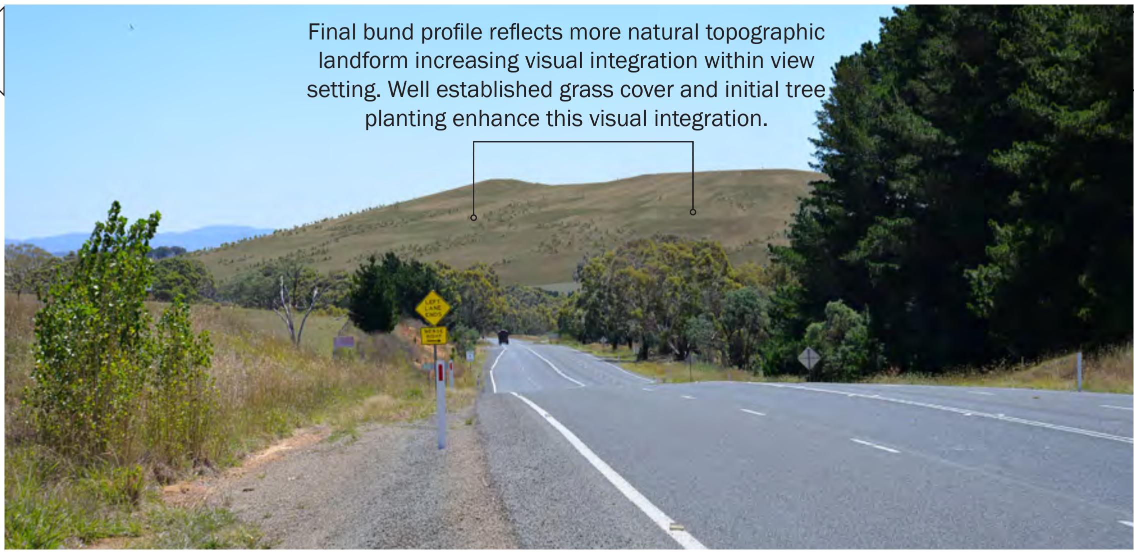
Photomontage VP5 - Existing view to Year 4

Figure 19.11

VP 5: Mid Western Highway - East

W



E

Year 8

W

E

Final Landform

Ref. VPA 2019

19.5 Visual impacts

An assessment of the visual impact and sensitivity of the mine development on the surrounding PVC is provided below.

i Northern view sector

Visual receivers in the northern view sector will be predominately screened by topography and vegetation, therefore limiting direct views of the mine development. There may be locations along Vittoria Road that will have views of the Secondary WMF and the TSF. From these locations the project will present a low to moderate visual impact during the mine life. The final rehabilitated landform will present a very low visual impact.

ii Eastern view sector

Where the mine development is visible in the surrounding landscape of the eastern view sector it will present a high visual impact during construction and a high to moderate visual impact during operation. The final landform will present a moderate to low visual impact.

Some fire and recreation trails within the Vittoria State Forest are within 2.5 km of the project area. During construction and operation, where there is no screening vegetation, the mine development will result in a high to moderate visual impact to views from these fire and recreation trails. The final rehabilitated landform will result in a very low visual impact.

iii Southern view sector

When viewed from residential receivers in the southern view sector, the mine development will result in a high visual impact during construction and a high to moderate impact during establishment of rehabilitation. The final rehabilitated landform will present as a low visual impact.

When viewed from the Mid Western Highway and Walkom Road, the mine development will result in a high visual impact during construction of the pit amenity bund and southern amenity bunds and high to moderate impact during rehabilitation of these bunds. The final rehabilitated landform will result in a moderate to low visual impact.

iv Western view sector

When viewed from residential receivers on Guyong Road, the mine development will result in a high visual impact during construction and operation and a moderate to low visual impact during rehabilitation. The final landform would result in a very low visual impact. For residential receivers in Blayney, the mine development will result in moderate to low visual impact during construction and operation and very low visual impact for the final landform.

The mine development will result in a moderate visual impact where visible along the Mid Western Highway in this view sector during construction and operation and moderate to low impact during rehabilitation. The final rehabilitated landform will result in a very low visual impact.

When viewed from the Billy Soo Rest Area, Heritage Park Rest Area and Church Hill Rotary Lookout, the mine development will result in a moderate to low visual impact during construction and operation. When viewed from these areas, the final rehabilitated landform will result in a very low visual impact.

19.6 Lighting impacts

There are two types of lighting effects (also termed light pollution) that could be generated by the project, direct light effects and diffuse light effects. Direct light effects result from when the light source is directly visible and will be experienced if there is a direct line of sight between the light source and viewpoint.

Diffuse light effects relate to the general night-glow that results from light of sufficient strength being reflected into the atmosphere. Diffuse light effect will create a local focal point that will vary with distance and atmospheric conditions such as fog, low clouds and/or dust particles which all reflect light.

Both of these light effects are absent in the existing environment immediately surrounding the project area. Local townships generate low levels of night glow.

19.6.1 Direct light

Direct lighting effects will occur during early mine development activities and the earthworks for the southern and pit amenity bunds and waste rock emplacement. These activities will be observed by sensitive receptors to the south of the Mid Western Highway and from residences in the western view sector along Guyong Road. Residences in the east and north will be shielded from direct lighting by a combination of local topography and intervening vegetation.

Following the development of the pit and southern amenity bunds, direct lighting to the south will be shielded, however direct lighting may be associated with the processing plant and may still impact on some residences in the western view sector along Guyong Road.

i Diffuse light

Light pollution and sky glow in the PVC are currently limited to that created by Blayney township (8 km) from the project area thereby reducing Blayney's sensitivity to this visual effect. Kings Plains and the residences around the project area generate insignificant light pollution resulting in dark sky night conditions and higher sensitivity to any changes.

Any diffuse lighting effects will have lower but broader effects due to the prevalence of atmospheric moisture or background particulate matter such as dust or fog. This will create a halo of light above the source of construction and operational lighting.

During the construction and operation of the project, the increase in radiance levels and resulting diffuse light effects associated with the project will increase significantly from existing low levels. Localised sky glow will be experienced by residential receptors in all view sectors. There is potential for diffuse light from the project to be observed from elevated locations, such as from the highest vantage points at the Church Hill Rotary Lookout in Blayney and will be distinguishable within the dark sky local context.

The visual impacts of diffuse lighting associated with the project will be significant compared to the low existing diffuse lighting levels.

Mitigation measures (on-site and off-site) that will be incorporated into the project design are discussed in Section 19.8. These mitigation measures will reduce the visual effect of the project, but due to sensitivity in relation to night lighting, the visual impact of night-lighting on sensitive receptors will be moderate to high.

19.7 Cumulative impact

Cumulative impacts may result from the combined effects of the mine development and existing extractive development in proximity to the mine development such as Cadia Valley Operations, historic Browns Creek Mine and quarries within the region.

Cumulative impacts will be unlikely to occur when multiple developments are visible from the same view location at the same time apart from elevated locations such Church Hill Rotary Lookout in Blayney. Cumulative impacts may occur when multiple developments are visible successively as the viewer moves through the landscape. This may occur as a viewer travels along the Mid Western Highway between Bathurst and townships further west.

The development project, involving new or upgraded electric transmission (assessed under separate Part 5 approval) and construction of the pipeline development, in addition to the core mining operations, when taken together have the potential for transforming landscape character in a relatively short time frame.

19.8 Dynamic landscape assessment

A dynamic landscape assessment was carried out by VPA (2019) as part of the VIA. Dynamic visual assessment takes into account human perceptions of the landscape (beyond sight) through sound (blasting and traffic), smell and touch (dust). The natural and cultural/social elements of the landscape have been assessed by other relevant technical experts. Accordingly, VPA's dynamic landscape assessment is focused on three components:

- ephemeral effects;
- other visual effect experiences at regional and subregional scale;
- educational inputs.

Dynamic landscape assessment considers these perceptions from both outside the PVC and within it in areas that do not have views of the project. The existing visual landscape settings inform perceptions of current mining affected landscapes and possible changes to those settings. Those settings include:

- local setting (Kings Plains, Guyong Road, Mid Western Highway);
- sub-regional setting (PVC) including Blayney; and
- regional setting (Bathurst/ Cabonne/ Orange region).

Receptors considered particularly sensitive to potential dynamic impacts of the project on the local landscape are:

- Kings Plains locality;
- rural residences; and
- Mid Western Highway.

The small locality of Kings Plains and rural residences are considered sensitive to potential dynamic landscape impacts given the aesthetic of the landscape is considered central to the rural way of life.

Views of the project from around the PVC more broadly, may contribute to the perceptions of the project at sensitive receptors (residential receptors) within Kings Plains in locations with no direct views to the project area.

In both the sub-regional and regional contexts, the Project's visible components are considered to be significant in terms of extent of visibility and the visual context which includes peaceful rural landscapes of high visual integrity.

Perceptions on the basis of knowledge gained by reading, hearing and or seeing reports on previous, existing and proposed activities having an effect on personal perceptions. This perception input goes beyond any consideration of visual perception as it is based on all inputs that create a knowledge base of a landscape setting and the projects within it. Such knowledge gained through public information would create an overarching awareness of the project

Based on intensity and extent of visual and other perceptual experiences of the project in the context of existing landscape settings that include minor mining activity in the locality, sub region and more significant mining within the region, the dynamic landscape impact is moderate to high. Such perceptions are likely to remain for a larger part of the operational phase, even when out of view, due to the complete knowledge set all members of the community have from information sessions and newsletters.

This high level of impact can be lowered by:

- reducing sensitivities through appropriate mitigation treatments and on/off site landscape treatments,
- demonstrate responsible and thorough implementation of recommended mitigation strategies, and
- continuing liaison and action with the community.

Dynamic impacts will reduce as perceptual effects relating to operations, including visual effects are reduced.

19.9 Management and mitigation measures

As outlined below the project design has incorporated numerous mitigation measures to mitigate the potential visual impact of the project. The VIA (VPA 2019) has subsequently identified a wide range of management and mitigation measures to manage the potential visual impacts of the project including both onsite treatments as well as offsite treatments at viewer locations to reduce visual sensitivity.

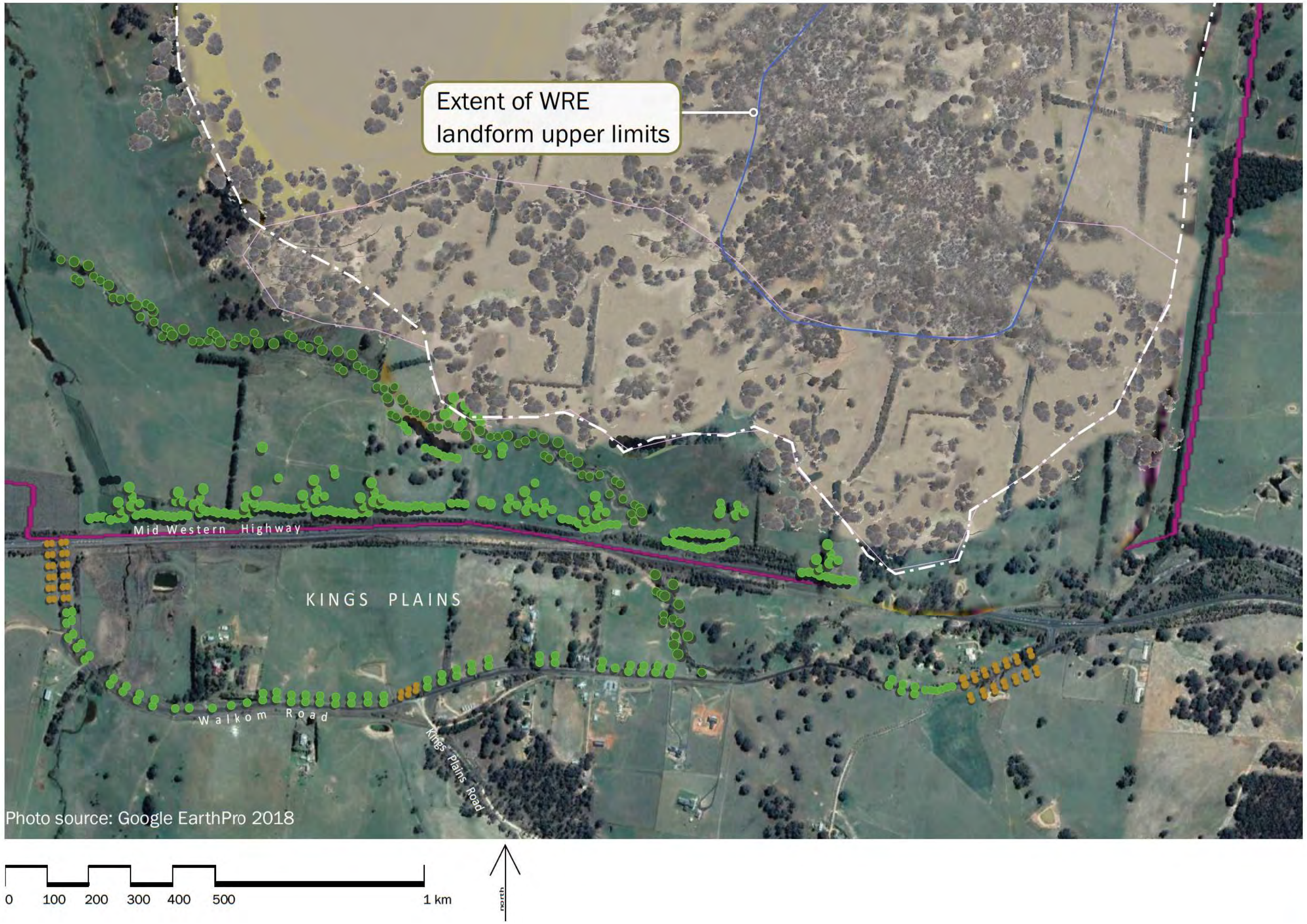
A key aspect of visual impact mitigation will be strategic landscape plantings. An indicative overview of onsite and offsite landscape plantings is presented in Figure 19.13.

19.9.1 Project design

Numerous opportunities to mitigate the visual impact of the project have been identified during the evolution of the project and subsequently included in the project design to manage the potential visual impacts of the project, these include:

- the processing plant and mine infrastructure areas will be located to maximise the separation of these project elements and sensitive receivers and to take advantage of existing topography that will screen these elements;
- the open pit and southern amenity bunds will be developed as a priority to screen development of open cut, infrastructure and haul roads at early stage of mine development;
- the waste rock emplacement staging will be refined to create progressive minor screening bunds;
- micro-topographic design will be incorporated into the final landform;
- the site access road and intersection with the Mid Western Highway will be located to the east of ridge lines in the east of PVC; and

- property acquisition has been undertaken to provide a substantial buffer in some directions between the proposed mine infrastructure and nearby residences.



key

Limit of Mine Project disturbance

Extent of pit and southern amenity bunds

On-site rehabilitation to amenity bund and WRE

Open woodland planting densities to top of WRE

Woodland irregular edge patterning to bund faces

Cultural hedgerow planting pattern to lower slopes of bund

Off-site visual mitigation planting to Mid Western Highway

Tree screen planting along northern highway verge and within Mine Lease boundary

Rehabilitation/ screen planting to existing and reinstated creeklines

Off-site visual mitigation planting to Walkom Road

Formal entry /avenue planting to intersections using seasonal flowering / canopy tree species.

Formal avenue planting to northern verge of Walkom Road using shade/ canopy trees.

Ref: VPA 2019

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On site and offsite rehabilitation and visual mitigation – Mid Western Highway and Walkom Road

Figure 19.13

19.9.2 On-site mitigation

On-site treatments involve rehabilitation of landforms and land cover and will include measures for respective elements of the mine development as follows:

- open cut mine pit:
  - seed collection will be commenced prior to the start of the project from native vegetation that will be cleared for use in replanting and landscape rehabilitation programmes;
  - machinery and vehicle exclusion zones will be implemented to protect remaining vegetation;
  - barriers, such as shipping containers, which are consistent in colour to the surrounding vegetation will be strategically positioned where required to provide screening for residential receivers from the open cut mine pit;
  - vehicle routes in the project area will be planned to minimise direct light to residential receivers located south of the project area; and
  - end of life outcomes for the open cut mine pit will be considered that can be functional or recreational and of benefit to the local and regional community.
- waste rock emplacement area:
  - the southern face of the amenity bund and waste rock emplacement will be completed as the highest visual priority and will be completed to provide a visual and landscape buffer for residences to the south, most significantly Kings Plains;
  - the waste rock emplacement will be progressively rehabilitated using planting mixes to create cover crops and longer-term grass cover that will emulate surrounding grassland so that natural grassland colouring and texture can be achieved following establishment;
  - a planting strategy with be designed with the community using a combination of grasslands woodlands and cultural planting patterns that emulate existing patterns in the landscape to recreate a pattern in keeping with existing landscape pattern and avoiding ill-considered mass plantings that reflect regular row and planting patterns except in cultural hedgerow plantings for lower slope areas;
  - new plantings will be maintained and where necessary replacement landscape works will be undertaken to ensure planned patterns are achieved and viable in the longer run; and
  - upon mine closure, consideration will to be given to the creation of a tourist lookout on a high point in consultation with community.
- ROM pad:
  - the ROM pad and retention batters will be rehabilitated early in the mine life with vegetation consistent with the existing vegetation pattern and type of the surrounding landscape;
  - remaining and planted vegetation will be maintained and any areas with unsatisfactory levels of regrowth will be reseeded;

- barriers, such as shipping containers, which are consistent in colour to the surrounding vegetation will be strategically positioned to provide screening for residential receivers from the ROM pad.

- Lighting during construction and operation will comply with AS/NZS:4282:2019 Control of the Obtrusive Effects of Outdoor Lighting. Additional measures to lessen the impact of direct and diffuse lighting will include:

  - appropriate positioning and aiming of lights;
  - use of shielded fittings where appropriate:
  - restriction of night lighting to minimum timeframes required;
  - use of energy efficient and sensor lighting where appropriate;
  - use of asymmetric beamed flood lights where appropriate; and
  - use of warm coloured fixed lights where possible.

19.9.3 Offsite mitigation

Off-site mitigation will be carried out in consultation with land holders that will experience moderate to high visual impacts. It should be noted that off-site treatments have already been initiated on several residential properties south of the project area.

Off-site mitigation measures will also include the development of roadside tree screens.

i Residences

Residences to the south and south-west of the project area will be the most affected by the project operations. These residences have been categorised according to the levels of visual impacts from views to the project. This is dependent on the amount of the primary view zone (PVZ) is occupied by views to the project components.

Views will vary from different residences due to screening by intervening topography and vegetation (either natural or part of visual mitigation planting). A range of treatments are recommended with a sliding scale budget relating to the degree of impact based on distance and orientation of view to mine operational areas.

Further engagement will be undertaken with potentially impacted landholders to test suitability of identified mitigation measures as follows:

1. A landscape workshop will be conduct to illustrate visual planning and landscape theory and practice and its application to a range of typical visual interaction conditions. All affected residents will be invited to attend.

2. At this workshop a range of approved treatments and their applications will be illustrate in the context of visual impact mitigation. These treatments may be demonstrated via field visits to existing residential sites.

3. Upon request, Regis will work with individual land owners to develop site specific landscape concept plans using a range of soft and hard landscape solutions to implement visual screening/integration strategies for affected properties.

Management measures may include:

- soft landscape works such as tree planting will be implemented as soon as practical, to maximise plant growth;
- hard landscape works will be implemented when planning approval is granted; and
- planting will be supplemented with appropriate landscape management strategies, including water supply, weed control and fertilizing consideration for a two to three year establishment and consolidation period.

ii Roads

Landscape plantings will be carried out along the Mid-Western Highway, Walkom Road and to a lesser degree Guyong Road due to increase distance from operations. Such plantings will enhance local amenity post mining especially in Kings Plains. Such planting strategies will be designed in consultation with the community.

19.9.4 Lighting mitigation

The following measures will be implemented to mitigate direct and indirect lighting impacts of the project:

- All external lighting associated with the project will comply with AS/NZS 4282:2019 – Control of the Obtrusive Effects of Outdoor Lighting, including the minimisation of light spill through the following:
    - night lighting will be minimised where appropriate to the minimum required for operations and safety requirements;
    - use of unidirectional lighting techniques and adequate aiming of lights (including consideration of mounting heights);
    - use of shielded fittings to limit the spill of lighting where available and safe to do so;
    - use of anti-reflective paint to light spill surfaces (where the designer has a choice of surfaces, it is desirable that a surface with the lowest practical reflectance be selected, compatible with the function of the area),
    - upward spill light will be minimised and lighting will generally be directed either downwards, or away from the south and Kings Plains;
    - energy efficient lighting will be used for any new fixed lighting installed, where available and safe to do so;
    - where floodlights are required, asymmetric beams will be used. Fixed lights will not be directed towards reflective surfaces;
    - where necessary and in consultation with affected landholders, screening (curtains, cladding, natural or physical screening) will be provided on private properties; and
    - lighting will use warm white colours for fixed lighting, where available and if compliant with industrial lighting standards.

19.10 Conclusions

Generally, there will be high level visual impacts to sensitive receptors in Kings Plains , rural residences and the Mid Western Highway in the Southern View Sector up to Year 4 following the completion and progressive rehabilitation of the southern amenity bund. A number of rural residences in the Eastern and Western View Sectors will also experience high levels of visual impact during the initial stages of the mine development.

Following completion of a number of strategic on-site mitigation treatments and rehabilitation establishment, visual effects will be reduced but will remain moderate to high for many project components over the life of the mine operations where there are direct views onto operational components. This reduction will be significant in the long term as the new post mining landforms become integrated with surrounding rural landscape character via micro-topographic design and careful rehabilitation tree planting patterns.

Night-lighting from the mine infrastructure area and movement of mine fleet will contribute significantly to the sky glow in this existing dark sky locality. Distance will reduce the visual impacts from more distant sensitive view locations in the west as it becomes part of the greater sky glow prevalent around Blayney.

It is considered that the dynamic landscape impact is moderate to high based on intensity and extent of visual and other perceptual experiences of the mine development in the context of historic and existing mining in the region.

Chapter 20

Social assessment

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20 Social assessment

20.1 Introduction

A social impact assessment (SIA) was prepared by Hansen Bailey for the project in accordance with the *Social Impact Assessment Guidelines for State Significant mining, petroleum and industry development* (DPE 2017) (the SIA guidelines). The assessment identified the potential impacts and opportunities associated with both the construction and operational phases of the development, as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

The SIA considered both the mine development and the pipeline development. This chapter summarises the SIA of the mine development, whilst Chapter 33 summarises the SIA of the pipeline development. The full SIA report is attached in Appendix T.

20.2 Assessment requirements and methods

The EARs relating to the social impact assessment are presented in Table 20.1.

Table 20.1 Social impact assessment related EARs for the mine development

Requirement	Where addressed
An assessment of the social impacts of the project, prepared in accordance with the *Social Impact Assessment Guideline for State Significant Mining, Petroleum Production and Extractive Industry Development* (2017), including the likely impacts of the development on the local community, cumulative impacts (considering other mining developments in the locality), and consideration of workforce accommodation.	This chapter and Appendix T.
An assessment of the likely economic impacts of the development, paying particular attention to:	
• the significance of the resource;	Chapter 38 (Project justification)
• economic benefits of the project for the State and region;	Chapter 36 (Economics)
• the demand for the provision of local infrastructure and services; and	Section 20.5.1
• consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services.	Section 20.6
During the preparation of the EIS, you should consult with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups, Registered Aboriginal Parties (RAPs) affected landowners, and holders of existing mining and exploration authorities intersected by the proposed pipeline corridor. You must also establish a Community Consultative Committee for the project in accordance with the *Community Consultative Committee Guidelines for State Significant Projects*, and consult with the committee during the preparation of the EIS. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	The consultation carried out for the purposes of the SIA is described in Section 20.3. The broader consultation conducted for the EIS is described in Chapter 4.

The methodology used to undertake the SIA, consistent with the SIA guidelines, included:

- identification of the project social area of influence;
- profiling the socio-economic environment of the project's social area of influence informed through a review of existing information and consultation with affected individuals and communities;

- identification and assessment of potential socio-economic impacts using a combination of qualitative and quantitative tools, including scenario assessment of potential workforce employment arrangements;
- assessment of the significance of identified impacts and opportunities in accordance with the SIA Guideline; and
- development of appropriate frameworks for managing and monitoring potential socio-economic impacts and opportunities.

The SIA study area was defined by the mine development's potential social area of influence, and was divided into three levels, as listed below and defined in Table 20.2:

- the Primary Assessment Area (PAA);
- the Secondary Assessment Area (SAA); and
- the Regional Assessment Area (RAA).

Table 20.2 SIA study area definition for the mine development

SIA study area component	
PAA	Defined as the area within an approximate 2 km radius of the mine project area inclusive of the Kings Plains locality and Kings Plains settlement. An estimated 88 private residences are located within the PAA, the majority to the south of the mine project area along the Mid Western Highway and to the west along Guyong Road. The estimated population of the PAA is 230 people[8].
SAA	Defined as the Blayney LGA (Figure 4). The main communities of interest within the Blayney LGA are Blayney and Millthorpe. Outside of the PAA, the primary area of influence of the project is likely to be the town of Blayney.
RAA	Defined as the combined LGAs of Bathurst, Blayney, Cabonne, Cowra and Orange City.

20.3 SIA consultation

20.3.1 Approach

An extensive stakeholder engagement program was carried out by Hansen Bailey and Regis to inform the SIA. The objectives of this consultation were to:

- ensure community members and stakeholders understand the project details, timing, and workforce arrangements so that discussions about impacts and benefits are meaningful;
- provide a range of opportunities to encourage community members and key stakeholders to participate in discussion;
- provide inclusive engagement throughout the assessment process; and

[8] ABS 2017b – 2016 ABS Meshblock counts (10056010000, 10149310000, 10149300000, 10115610000, 10116070000, 10116130000) were used by Hansen Bailey (2019) to calculate the estimated population of the PAA. The combined area of these Meshblocks is larger than the PAA and includes a total of 109 dwellings and 285 people. This indicates an average occupancy rate of 2.6 persons per dwelling. There are 88 dwellings in the PAA. Applying the rate of 2.6 persons per dwelling the population of the PAA is estimated at approximately 230 people.

- ensure the SIA considers the interests, lived experiences, perspectives, opinions and perceptions of people who may be directly affected by project impacts.

Key stakeholders for SIA consultation were identified during the SIA scoping phase, with some additional stakeholders identified as the study progressed. The groups of stakeholders consulted with included:

- previous landowners/leaseholders within the mine project area;
- landowners near the mine project area, within an approximate 2 km distance;
- downstream landowners;
- nearby communities;
- local government – Blayney Shire, Bathurst Regional and Lithgow City Councils;
- business community – including businesses in Blayney and accommodation providers in the LGAs of Blayney, Bathurst, Lithgow and Orange;
- Government and non-government service providers and infrastructure providers – including education and childcare, health and medical, emergency services, disability and elderly support services, housing support services and school bus providers;
- Industry groups – including Central Tablelands Water and the NSW Farmers Association;
- Community groups and non-government organisations (NGOs), including:
    - Blayney interest groups, eg Rotary, Probus
    - Blayney sport and recreation groups, eg Blayney Fishing Club
    - Community action groups, eg BHPG
    - Blayney religious organisations, eg Abundant Life Church
    - Town and Village Associations eg Blayney Town Association, Millthorpe Village Committee (MVC)
    - Tourism Associations, eg Orange360 and Blayney Shire Visitor Information Centre
- Elected representatives - Blayney Shire Council Councillors.

SIA consultation included three rounds of structured engagement over 18 months:

- Round 1 – Scoping engagement;
- Round 2 - Impact identification; and
- Round 3 - Validation of impacts, opportunities, and proposed management strategies.

A total of 71 meetings were held with 337 participants during the three rounds of engagement.

20.3.2 Consultation findings

The consultation found that across the Blayney LGA there are a range of views towards the mine development. These views vary from strong opposition through to strong support.

The consultation also identified impacts broadly in two categories; impacts experienced to date relating to the project, and the impacts that stakeholders perceive could occur as a result of the project.

i Experienced impacts

In relation to the first category, near neighbours (ie within around 2 km of the project area) identified a number of project-related social impacts experienced to date as:

- stress and anxiety – residents in Kings Plains cited elevated levels of stress and anxiety due primarily to uncertainty, and specifically:
  - whether the project would proceed;
  - the mine life;
  - the potential impacts and the extent to which they might be impacted;
  - the ability of Regis to suitably manage or control the impacts;
  - the opportunity for property acquisition and/or compensation; and
  - the potential impact on property values and saleability of property in the locality in the event that residents seek to relocate during the approvals process or following determination.
- conflict and reduced community cohesion – a number of Kings Plains residents cited evidence of a growing divide in the Kings Plains settlement due to differing attitudes towards the project and differences in opinion as to the perceived benefits and impacts of the project. Some residents also indicated the presence of conflict within families due to divergent project opinions.

ii Perceived impacts

In relation to the perception of potential impacts of the project, the consultation showed that resident attitudes towards the project and perceptions of social impacts is influenced by proximity to the project. The closer a resident is to the project area, the greater the number of perceived social impacts raised during engagement and the fewer project benefits identified. The key areas of concern in relation to potential impacts of the mine raised during consultation included:

- amenity impacts - the majority of near neighbours, particularly residents of the Kings Plains locality, perceive that the project will adversely impact the social, economic, cultural and environmental attributes of the locality that collectively enhance their way of life;
- impacts to existing way of life - concerns regarding a reduction in the use and enjoyment of both indoor and outdoor spaces due to amenity impacts from the project;
- impacts to rural values - residents have a strong attachment to a specific vision of life in the locality, which emphasises its rural character and amenity;

- changes in accessibility to water - many residents close to the project area perceive that the project will impact the quality and quantity of water in private groundwater bores and the Belubula River;
- private property impacts - near neighbours perceive that the project will adversely impact private property values; and
- impacts to health and wellbeing – many residents fear the health impacts of having a mine in close proximity, particularly in relation to dust.

iii Perceived opportunities

Local benefits from the project were identified primarily by the broader community of the Blayney LGA. Potential project benefits identified by the broader community included:

- economic growth
- job creation - residents noted it would be good to have another locally based employment generator that attracted labour back into Blayney and provided opportunities for existing school leavers;
- improvement and/or expansion in services and facilities; and
- increased local spend.

A detailed review of the findings from the consultation conducted for the SIA is provided in Appendix D of the SIA report (refer to Appendix T), which also includes a list of all issues (positive and negative) raised during SIA consultation and in relation to the project.

20.4 Social baseline

20.4.1 Secondary assessment area (Blayney LGA)

The Blayney LGA is quintessentially a rural shire, and in addition to the main township of Blayney, includes the villages of Barry, Carcoar, Lyndhurst, Mandurama, Millthorpe, Neville and Newbridge. Except for Millthorpe, these villages support fewer than 150 residents.

Land use across the LGA has changed little over time, with agriculture and mining remaining the dominant land uses. Rural values remain strong across the LGA as evidenced in the Blayney LGA planning framework and in the *Orange, Blayney and Cabonne Regional Economic Development Strategy 2018- 2022* (AgEconPlus 2018). Extractive industry activities occur around the township of Blayney with a significant new quarry operation recently proposed on the north western side of Blayney. Infigen Energy is proposing the development of the Flyers Creek windfarm near Errowanbang Road within the Blayney LGA and Newcrest has future works proposed at Cadia Valley Operation (CVO).

The township of Blayney is the administrative and service centre of the LGA, providing a range of goods and services including medical services, primary and secondary education services, and retail and professional services. Commercial growth in Blayney township has been slow due to the proximity of the township to Bathurst and Orange and the diverse range of services and facilities offered in these locations. Tourism is an increasing industry sector in the Blayney LGA. The Blayney LGA is growing in popularity as a weekend and short stay destination with the historic buildings and streetscapes of Carcoar and Millthorpe being the key attractions.

The estimated resident population (ERP) of Blayney in 2018 was 7,342 people, and the recorded 2016 ABS Census ERP for Blayney LGA was 7,257 people (ABS 2017). The majority of the population is concentrated in the centres of Blayney (2,963 people, 40% of LGA population) and Millthorpe (735 people, 10.1% of LGA population) (ABS 2017).

Between 2006 and 2016 the population of Blayney LGA increased by 10% representing slow but steady population growth. Blayney LGA experienced a smaller population increase than the neighbouring LGAs of Orange City and Bathurst (13.8% and 14.8%, respectively) but a similar increase to that experienced in the Cabonne LGA (ABS 2017a).

In relation to employment, in December 2018 the Blayney LGA had an unemployment rate of 4.6% (182 persons), compared to an unemployment rate of:

- 5.3% (1,218 persons) in Bathurst LGA;
- 3.1% (231 persons) in Cabonne LGA;
- 8.7% (512 persons) in Cowra LGA; and
- 5.7% (1,256 persons) in Orange LGA.

Mining, agriculture and manufacturing have been the mainstay of the Blayney LGA economy for many years. In 2016 in the Blayney LGA, the:

- mining industry sector employed 727 (24% of total employment across all industry sectors);
- agricultural industry sector employed 392 people (13% of total employment across all industry sectors); and
- manufacturing industry sector employed 368 people (12% of total employment across all industry sectors).

20.4.2 Primary assessment area

The PAA is the area within approximately 2 km of the mine development and includes the Kings Plains locality and Kings Plains settlement. It can be divided into two discrete geographic catchments:

- the Kings Plains locality – consisting of all land to the south of the mine project area, including the Kings Plains settlement; and
- Guyong Road and surrounds – consisting of all land to the west and north of the mine project area, ie Guyong Road, Vittoria Road and the Mitchell Highway.

Kings Plains settlement is located immediately south of the project area and is the closest settlement to the mine development. Kings Plains settlement consists of the 19 private residences located in proximity to Walkom Road. In April 2019 Kings Plains settlement had an ERP of 45 people (Hansen Bailey 2019). It consists of a combination of rural lifestyle blocks and larger rural landholdings. The Drayshed Nursery accommodation is located in the Kings Plains settlement on Kings Plains Road

The broader Kings Plains locality consists of all land to the south of the mine project area and includes the settlement of Kings Plains on Walkom Road. In 2016 the Kings Plains locality had an ERP of 132 people (Hansen Baily 2019). The Kings Plains locality broadly aligns with the ABS geographic area of Kings Plains State Suburb (SS) (SSC12151). The Kings Plains SS encompasses the large majority of the mine project area.

The population of the settlement of Kings Plains is a mix of retired couples, families and young couples. There are a number primary and secondary aged children living in Kings Plains settlement.

Similar to the Kings Plains locality, the settlement of Kings Plains has a low level of population mobility with many residents residing in the locality for more than 15 years. At least two families in the Kings Plains settlement have strong long-term family connections to the locality.

Kings Plains has no community buildings, other than the Kings Plains Rural Fire Brigade (RFB) and is not serviced by Blayney Shire Council services such as refuse collection or town water. Few buildings remain of the former township of Kings Plains.

20.5 Impact assessment

20.5.1 Secondary assessment area

The predicted social impacts of the project on the Blayney LGA are largely confined to the construction phase of the project. As described in Chapter 2, the construction phase and operational phases overlap. In the context of the social assessment, the construction phase relates to the time that a construction skilled workforce is predominantly on site, which is anticipated to be for around 18 months (refer to the project schedule in Figure 2.3). The impacts during this time are expected to be primarily associated with the influx of a temporary construction workforce to the Blayney township and the associated demand for short-term accommodation and private rental housing.

i Population change

The anticipated population and demographic changes likely to be experienced in the Blayney LGA during the construction and operational phases of the project are based on the estimated number of local and non-local hires.

In relation to a local hire, the daily commute distance from a worker's usual place of residence to the mine project area that will be acceptable to Regis is approximately one-hour, reflecting the requirements of Regis corporate health and safety standards. A local hire therefore is defined as any person who resides within an approximate one-hour commute of the mine project area (herein defined as the 'local area'). The anticipated number of local hires versus non-local hires are summarised in Table 20.3.

Table 20.3 Estimated proportion of local hires and non-local hires

Project Phase	Local Hire		Non-Local Hire		Total workforce
	Percent (%)	Number	Percent %	Number	
Construction phase – Scenario 1					
Processing plant construction	55	209	45	171	380
Open cut development	75	158	25	52	210
Pipeline construction	20	24	80	96	120
Total		**391**		**319**	**710**
Construction phase – Scenario 2					
Processing plant construction	20	76	80	304	380

Table 20.3 Estimated proportion of local hires and non-local hires

Project Phase	Local Hire		Non-Local Hire		Total workforce
	Percent (%)	Number	Percent %	Number	
Open cut development	80	168	20	42	210
Pipeline construction	20	24	80	96	120
Total		**268**		**442**	**710**
Operations					
Scenario 1 - preferred arrangement	80	208	20	52	260
Scenario 2 - alternative arrangement	60	156	40	104	260

Note: 1. Data used is based on FTE peak workforce for the construction phase and FTE annual average workforce numbers for the operations phase.

a Construction

The construction phase is predicted to result in a temporary increase in the population of the local area over a period of around 18 months, predominantly within the Blayney township. Due to the short duration of the construction phase, the transient nature of construction work and the proximity of the project to neighbouring regions with skilled construction workforces it is unlikely that families will accompany construction workers to the local area for the duration of the construction phase.

As shown in Table 20.3, approximately a third of non-local hires are anticipated to move into the Blayney LGA. The construction phase for the mine development is anticipated to result in an influx of around 223 workers to the Blayney LGA at peak construction under Scenario 1 and around 346 workers under Scenario 2. Under the highest prediction scenario where all 223 workers or 346 workers reside in the township of Blayney, this is equal to a temporary increase of 7.5% (Scenario 1) or 11.7% (Scenario 2) in the 2018 ERP of Blayney. However, it is more than likely, the number will be less due to constraints on accommodation availability in the Blayney LGA, as described in Section 20.5.1 ii, and the resulting dispersal of the workforce to neighbouring centres such as Bathurst and Orange. Regis will seek to control the number of non-local hires temporarily residing in the Blayney LGA, and in particular Blayney through the implementation of a Construction Workforce Accommodation Strategy.

b Operations

To enable consideration of the likely population change across the region as a result of the project, a number of predictions were made regarding the final residential location of the non-local hires. These assumptions, based on the average annual workforce, are discussed in the SIA report (refer to Appendix T) and summarised in Table 20.4.

Table 20.4 Predicted final residential location of non-local hires during operations[1]

Residential Location	Scenario 1 – Preferred Project Arrangement				Scenario 2 – Alternative Arrangement			
	LHs		NLHs		LHs		NLHs	
Blayney LGA	25%	65	8%	20	20%	52	16%	42
Orange LGA	25%	65	6%	16	20%	52	12%	31

Table 20.4 Predicted final residential location of non-local hires during operations[1]

Residential Location	Scenario 1 – Preferred Project Arrangement				Scenario 2 – Alternative Arrangement			
	LHs		NLHs		LHs		NLHs	
Bathurst LGA	15%	39	6%	16	10%	26	12%	31
Cabonne LGA	10%	26	0%	0	5%	13	0%	0
Cowra LGA	5%	13	0%	0	5%	13	0%	0
Total	**80%**	**208**	**20%**	**52**	**60%**	**156**	**40%**	**104**

Note: 1. Data used is the annual average workforce numbers.

As can be seen in Table 20.4, under each scenario around 20 non-local hires (Scenario 1) and 42 non-local hires (Scenario 2) are anticipated to move to the Blayney LGA. Assuming each worker brings family and their average household size is similar to that of Blayney (ie 2.4 people per household) then the following additional population is anticipated:

- Scenario 1 – 48 people (20 new households), equating to 1.5% of the existing population of Blayney; and
- Scenario 2 – 101 people (42 new households), equating to 3.4% of the existing population of Blayney.

It is anticipated that the majority of the non-local workforce relocating to the Blayney LGA will choose to reside in Blayney township or nearby Millthorpe. The benefits of this population increase is described in Section 20.5.3.

ii Access to housing and accommodation

Predicted impacts on housing and accommodation availability are directly related to the number of local hires versus non-local hires anticipated. Impacts were accessed for the two hiring scenarios for each phase of the project, as shown in Table 20.5. It is noted that these numbers include both the pipeline and the mine development.

Table 20.5 Non-local hires by project phase

Project Phase	Number of Non-Local Hires	
	Scenario 1 – Preferred project arrangement	Scenario 2 – Alternative project arrangement
Construction Phase	319	442
Operations Phase	52	104

The impacts on housing and accommodation associated with construction and operation are summarised below.

<u>Construction</u>

The construction workforce accommodation demand has the potential to:

- impact short-term accommodation accessibility in the Blayney LGA (primarily Blayney township) for the non-mining sector and tourism industry for the duration of the construction phase;
- displace low income households from private rental accommodation; and
- reduce accessibility for existing and new non-mining residents to private rental accommodation.

The construction phase workforce will be accommodated in a combination of the following options within the local area:

- short-term accommodation such as hotels and motels;
- private rental accommodation; and
- Regis owned housing within the Blayney LGA.

Across the project life, the construction phase is predicted to have the greatest impact on short-term accommodation provision in the local area, particularly in Blayney LGA. Under both scenarios, most of the demand is likely to be felt in the townships of Blayney and Millthorpe, due to their proximity to the project area. Sustained demand for short-term accommodation in the Blayney LGA has the potential to adversely impact the local tourism industry sector by reducing accessibility to short-term accommodation for visitors to the LGA.

There are approximately 170 rooms of short-term accommodation available across the Blayney LGA, with the majority located in hotels and motels within Blayney and some of the villages in the LGA.

Based on an anticipated 319 or 442 non-local construction workers under scenario 1 and 2 respectively, there is an insufficient supply of rooms in short-term accommodation in the Blayney LGA to meet the accommodation demands of the construction phase without impacting on the tourism industry. Mitigation measures proposed to alleviate the pressure on housing demand are described in Section 20.6.

<u>Operations</u>

During the operational phase of the project, the following outcomes are anticipated in relation to housing and accommodation demand:

- under Scenario 1, the project would directly generate demand for up to 52 dwelling units in the local area of which 20 dwelling units would be required in the Blayney LGA; and
- under Scenario 2, the project would directly generate demand for up to 104 dwelling units in the local area of which 42 dwelling units would be required in the Blayney LGA.

Therefore, the Blayney township will likely experience the greatest demand of housing, equivalent to the majority of the 20 or 42 dwellings under each scenario.

iii Services

During the construction phase health services in Blayney LGA may experience an increase in service demand due to the presence of the construction phase workforce. Increased demands on education or childcare services in Blayney or other local towns are not expected, as construction workers are not anticipated to bring their families to the local area.

During operations, the level of population increase associated with Scenario 1 is unlikely to result in substantial impact on service accessibility for existing residents or impact on the capacity of health services. Some increase in service demand may be experienced under Scenario 2; however, it will be substantially less than that experienced during the construction phase. In relation to schools and childcare services, the operations phase of the project is anticipated to directly attract the following to the Blayney LGA:

- around 8 family households with children (approximately 16 children) under Scenario 1; and
- around 17 family households with children (approximately 34 children) under Scenario 2.

Primary and high school enrolments generated in Blayney LGA by the incoming population are likely to be shared between a number of schools, including Blayney and Millthorpe Public Schools, St Joseph's Catholic School in Blayney, Blayney High School and private secondary schools in Orange and Bathurst. A disproportionate demand on any one school is unlikely due to the number of existing school facilities in the local area. Regis will engage with the NSW Department of Education to assist in planning for increased enrolments in the local area.

There will also be an increase in the demand for childcare services. The construction of a new childcare centre in Blayney is advanced and is due to open in late 2019. The addition of this childcare service will significantly improve accessibility to childcare services for the existing population and will also assist the incoming population associated with the mine development.

20.5.2 Primary assessment area

i Access

The mine development will require the closure or realignment of the portion of Dungeon Road that is located within the mine project area. Dungeon Road is a local road that is not bitumen sealed and provides access to two private properties and several Regis owned properties as well as the mine project area. The existing Dungeon Road will be closed to the public at the commencement of the construction phase and will likely remain permanently closed unless the road is realigned outside of the mine disturbance footprint. The road closure will not impact on the access to the two private properties at the southern end of Dungeon Road as their access to Blayney or Bathurst via the Mid Western Highway will remain unchanged.

At the northern end of Dungeon Road, there are two Regis owned dwellings outside the mine project area which will likely remain tenanted for the long-term. The presence of tenants in these properties means that Dungeon Road will remain open for the 1.2 km between the mine project area boundary and Vittoria Road. Access for these properties east towards Bathurst will remain unchanged, although access to the south on Dungeon Road towards Blayney be impacted. However, an alternative route with a similar travel time is available via Vittoria Road and Guyong Road. The alternative route is via bitumen sealed roads, whereas Dungeon Road is an unsealed gravel road. The condition of Dungeon Road means that Guyong Road is a more attractive route to travel between the two highways.

ii Amenity

As described in Chapter 5, there are around 88 rural and rural residential properties, as well as the Vittoria State Forest, surrounding the project area.

The predicted impacts on these nearby residences in relation to noise levels, air quality and visual amenity are described in detail in Chapters 10, 11 and 19 respectively. A brief summary is provided below.

No exceedances of the relevant EPA air quality criteria are predicted during construction or operation of the project (with the exception of one exceedance at sensitive receptor R38; Regis currently have an option to purchase this property following approval (refer to Figure 5.6). This is due primarily to the number of best practice mitigation measures that have been incorporated into the project design, such as the use of dust suppressants in the water trucks, the inclusion of dust control and extraction systems on crushers, screens and transfer points, and the progressive rehabilitation of disturbed areas throughout the mine life.

In relation to noise, with the exception of one property no exceedances are predicted of the construction noise criteria during the first six months of the mine development, when works are only anticipated to be undertaken during the daytime. Exceedances of up to 5 dB are predicted to occur at property R17 (shown in Figure 10.1). This exceedance will be temporary and associated with the construction of the new intersection for the mine access road off the Mid Western Highway, which is in close proximity to this house.

From around month 7 onwards, works will be undertaken 24 hours a day, seven days a week. In Year 1, exceedances are predicted at 15 houses in Kings Plains such that they will be entitled to the application of mitigation measures upon request (ie 3-5 dB above the noise criteria), in accordance with the VLAMP. Exceedances are also predicted at R38 which Regis currently have an option to acquire following project approval. A further 16 houses are also expected to experience some elevated noise levels up to 2 dB above the relevant noise criteria.

In Year 2, noise levels are expected to exceed the noise criteria by 1- 2 dB at 15 houses in Kings Plains, and by 3-5 dB at 7 houses in the Kings Plains locality including R38, which as noted previously, Regis have an option to buy following project approval. By Year 4, no exceedances that trigger the requirement for mitigation measures at residences are predicted; however, negligible exceedances of up to 2 dB are predicted at six houses.

In relation to visual amenity, residences around the mine project area, particularly in the Kings Plains locality and to a lesser extent to the west along Guyong Road, will experience a change in view. The impacts will be most significant in the first couple of years of the project as the southern amenity bund and pit amenity bunds are constructed and re-vegetated.

iii Access to water resources

Residents within the PAA expressed concerns during consultation that the mine development will lead to long-term impacts on the Belubula River system in addition to impacting groundwater accessibility for near neighbours.

The predicted impacts on surface water and groundwater accessibility are discussed in detail in Chapter 9. With respect to groundwater, no impacts on accessibility to groundwater for use by near neighbours is predicted. This is due to a number of factors, and particularly the tight geology within the project area, which means that groundwater drawdown will be largely confined to the project area and groundwater levels at third party landowner bores outside this area are not expected to decline by more than 1 m.

The water management system has been designed so that the mine will be a nil discharge site. Water management facilities/dams have been conservatively sized, and therefore the risk of any overflows off site and impacting on downstream water users is low. Chapter 9 describes in detail the measures incorporated into the design of the mine, including the management of PAF material and the TSF, so that significant impacts to water quality, thereby protecting downstream users, do not occur.

iv Surrounding agricultural users

Goldfields Honey is produced at the Beekeepers Inn, approximately 3 km to the north-east. Potential impacts to apiarian activities are mainly associated with a loss of habitat on the mine project area as a result of vegetation clearance activities. Box Gum woodland in the mine project area is understood to provide pollen for the bees managed by Goldfields Honey. The Biodiversity Assessment Report (refer to Appendix N) found that the mine development will result in a reduction of around 1.68% in the extent of Box Gum Woodland within a 5 km radius of the mine project area. It is therefore anticipated that the mine development will not result in a significant loss in foraging habitat for bees. A significant amount of Box Gum woodland in the northern part of the project area has been avoided by the design of the TSF.

A small number of residences also keep horses in Kings Plains. The impact on these residences and businesses was considered particularly with respect to blasting in the Noise and Vibration Assessment (refer to Appendix L). The assessment concluded that overpressure and vibration levels from blasting activities at the mine will be well below the regulatory criteria and considerably lower than other sources of overpressure that horses or livestock are likely to be already subjected to such as lightning strikes which are typically between 120dBZ and 130dBZ.

Detailed consideration of the mine development's potential impacts on local and regional agriculture is contained in Chapter 8 and Appendix I.

v Health and wellbeing

Several participants during the SIA consultation raised concerns in relation to potential health impacts from dust emissions. Residents expressed concern regarding the potential for contamination of rainwater. As discussed above no privately-owned properties will be impacted by exceedances of air quality criteria. This criterion has been set by the EPA in accordance with World Health Organisation standards. Importantly, an investigation of best practice dust control measures was conducted as part of the air quality assessment, and measures were iteratively added to the mine design where initial modelling of pollutant levels at the nearby residences were predicted to exceed criteria.

The AQIA did not identify any potential health impacts as a result of the project. Notwithstanding, to address existing resident fears and perceived uncertainty in relation to the health impacts of dust emission, Regis has commissioned a health impact assessment, to be completed in parallel with the project approvals process.

A number of residents within the PAA, particularly Kings Plains, described that they are experiencing elevated levels of stress and anxiety due to uncertainty in relation to a range of project factors including:

- whether the project would proceed;
- the mine life;
- the potential impacts and the extent to which they might be impacted;
- the ability of Regis to suitably manage or control the impacts;
- the opportunity for property acquisition and/or compensation; and
- the potential impact on property values and saleability of property in the locality in the event that residents seek to relocate during the approvals process or following determination.

The primary strategy to manage resident stress and anxiety in relation to the project is for Regis to engage in and maintain transparent, evidence-based and ongoing dialogue with concerned property owners and other community members, based on the results of the EIS.

During EIS exhibition, Regis will:

- ensure all residents of the PAA and other key stakeholders are made aware of the EIS exhibition period and have timely access to expert consultants to discuss the findings;
- undertake tailored consultation with residents of the PAA to ensure all residents are informed of the nature and magnitude of predicted impacts at their private property; measures to manage and or mitigate predicted impacts; and opportunities for compensation or property acquisition;
- offer to meet with downstream landowners to discuss the EIS findings; and
- offer to meet with the BHPG to discuss the EIS findings.

During the project approvals phase Regis will ensure all near neighbours remain informed of the progress of the project approvals process, opportunities to participate and any changes to the project description arising. Regis will also continue to meet with the project's Community Consultative Committee throughout the assessment process.

Another potential impact on health and wellbeing is sleep disturbance, which can also cause health related issues. SIA consultation identified that a number of residents of the PAA, and in particular Kings Plains are engaged in shift work employment such as mining and transport services. These residents raised concerns in relation to the potential for noise from the project to cause sleep disturbance during the day and at night. A sleep disturbance assessment was conducted as part of the NVIA (EIS Appendix L). The findings of the NVIA indicate that noise levels are compliant with the relevant criteria at all privately owned residences near to the project area. Further detail is contained in Appendix L.

20.5.3 Benefits and opportunities

The SIA predicted a number of potential economic and social opportunities associated with the mine development for the broader secondary and regional assessment areas.

The project will provide direct employment for up to:

- 590 workers at peak construction, with 55% assumed to already reside in the local area (ie within a 1-hour commute of the mine project area);
- 320 workers at peak operations, with an average annual direct workforce of approximately 260 and 80% assumed to already reside in the local area.

It will also provide indirect employment in the regional economy from employee and project expenditure. The economic impact assessment (refer to Appendix DD) found that the total annual impact of the peak year of construction on the regional[9] economy is estimated at up to:

- $531 M in annual direct and indirect regional output or business turnover;

[9] The regional area defined in the *Economic Impact Assessment* (Gillespie Economics, 2019) (Appendix DD) is the combined area of the LGAs of Blayney, Bathurst, Cabonne and Orange. This is different to the Local Area considered in the SIA which is defined as the combined area of the LGAs of Blayney, Bathurst, Cabonne, Cowra and Orange. Further, the Region in the SIA is defined as the Central West Region of NSW.

- $218 M in annual direct and indirect regional value added;
- $114 M in annual direct and indirect household income; and
- 1,289 direct and indirect jobs.

The main sectors in the regional economy likely to benefit from direct operational expenditure are Construction Services, Other Repairs and Maintenance, Professional, Scientific and Technical Services, Wholesale Trade, Exploration and Mining Support Services and Heavy and Civil Engineering Construction.

The project operation is estimated to make up to the following contribution to the regional economy:

- $492 M in annual direct and indirect regional output or business turnover;
- $272 M in annual direct and indirect regional value-added;
- $67 M in annual direct and indirect household income; and
- 788 direct and indirect jobs.

Economic activity in the region will also arise from the expenditure of the project's workforce in the region. The revenue, expenditure and employment associated with the construction and operation phases of the project will stimulate economic activity for the regional economy. The main sectors in the regional economy likely to benefit from direct expenditure of wages in the regional economy include retail trade, food and beverage services, health care services, wholesale trade and primary and secondary education services.

In addition to the economic benefits, Regis is currently negotiating a Voluntary Planning Agreement (VPA) for the project with Blayney Shire Council. The VPA is the primary mechanism for managing socio-economic impacts associated with the project and enhancing opportunities for the local area.

As described above, an estimated 20% and up to 40% of the operations phase workforce are anticipated to be non-local hires who will relocate permanently into the local area to take up employment during the operations phase. Based on scenario testing, the project has the potential to directly attract between 48 and 104 people to the Blayney LGA representing a population increase of 1.5% and 3.4% respectively.

The additional project induced population is anticipated to have the following potential positive benefits for the Blayney LGA:

- increased participation rates in local sporting groups and clubs supporting long term sustainability of these services;
- increased enrolments at local education institutions;
- increased pool of volunteer labour for local service and facility operations;
- introduce new and additional skills into the LGA which may support existing services and businesses and strengthen community cohesion; and
- stimulate demand for residential development in Blayney and neighbouring areas.

20.6 Management and mitigation measures

The SIA includes a wide range of actions to avoid, mitigate and manage potential social impacts of the project and enhance the delivery of benefits to the SAA and the broader RAA. Iterative project planning, informed by baseline studies and various technical studies as described in this EIS, has allowed a range of social impacts to be avoided and others to be minimised throughout the life of the project.

Three social impact management frameworks have been developed for the project:

- Stakeholder Engagement Framework;
- Near Neighbours Impact Management Framework; and
- Workforce Accommodation and Workforce Management Framework.

These management frameworks have been developed to:

- ensure residents of the PAA and broader community remain informed on the project and the project approvals process;
- mitigate and manage the project's social impacts on the communities of the PAA; and
- mitigate and manage the impact of the project workforce on the Blayney LGA particularly with regards to workforce accommodation.

The frameworks are presented in Appendix T and include mechanisms for monitoring the effect of the management measures in minimising likely social impacts and enhancing potential benefits.

The following key actions, defined in the Near Neighbours Impact Management Framework, will be taken to manage the predicted social impacts of the project in the PAA:

- ongoing stakeholder engagement – ongoing engagement with the Kings Plains community and residents of the broader PAA in relation to the progress of the project, the magnitude and extent of anticipated impacts and proposed management measures;
- property specific management plans – on request from residents in the PAA, Regis will develop property specific management plans to address property owners' specific concerns relevant to the project; and
- maintenance of a community complaints and grievances system, with investigation, response and where required, management actions undertaken for all complaints.

Prior to the commencement of construction, a detailed Construction Workforce Accommodation Strategy (CWAS) will also be developed. The strategy will be prepared in consultation with BSC, Orange360, key accommodation providers and where necessary proponents of existing or new major projects in the Blayney LGA. The strategy will:

- demonstrate how the construction phase workforce will be accommodated across the local area;
- demonstrate how workforce accommodation requirements will be managed during periods of high demand, such as during key regional events like the Bathurst 1000;

- document the approach to informing accommodation providers of predicted project workforce accommodation demands including anticipated timing;
- enable the coordinated placement of the workforce in tourism accommodation throughout the local area; and
- keep key stakeholders informed of predicted project accommodation demands across the construction phase.

In addition to the CWAS, Regis will:

- focus on securing local contractors during the construction phase, to reduce the size of the NLH workforce;
- monitor local and regional housing market activity in the period prior to construction to inform the CWAS, and make changes to the workforce accommodation strategy as necessary to manage potential impacts;
- engage further with Orange360 and accommodation providers in Bathurst and Orange LGAs to confirm occupancy rates and availability in short-term accommodation options in these locations;
- reduce workforce demands during periods of high regional accommodation demand, such as the Bathurst 1000, to free up short-term accommodation for the tourism industry sector;
- following commencement of operations, provide Orange360 with the long-term maintenance shutdown schedule for the mine, and where necessary ensure alignment of shutdown periods outside of periods of high accommodation demand e.g. Bathurst 1000;
- communicate with larger operating companies such as Purina, CVO and SeaLink to understand any expansion/reduction in services that may impact short-term accommodation availability in Blayney during the construction phase and take necessary action through the CWAS and in coordination with these companies to minimise any adverse impacts;
- undertake further engagement with Housing Plus and other relevant housing support services to identify suitable actions to offset potential short-term impacts on low to medium income households in the Blayney LGA; and
- establish joint meetings with representatives of other major projects or existing significant operations, such as CVO, in relation to any expansion work regarding management and monitoring cumulative impacts to the Blayney housing market.

A Community Consultative Committee (CCC) was established for the project in late 2018 in accordance with the EARs and will continue to operate for the life of the project. The key role of the CCC will be to foster dialogue between Regis, the community and key stakeholders regarding the project. The CCC will aim to provide community members with a voice and will give Regis a structured process for addressing community interests and concerns.

As mentioned in Section 20.5.3, Regis has commenced negotiations with Blayney Shire Council in relation to a VPA for the project. This VPA will be linked to the anticipated increase in demand on infrastructure and services of the mine development, which are only expected to occur in Blayney due to an increase in population, particularly during the first 18 months or so of the project as a result of an influx of construction workers.

The following additional management tools will also be developed prior to the commencement of the project construction phase to manage potential social impacts and support the realisation of opportunities across the project life:

- Social Impact Management Plan;
- Stakeholder Engagement Plan;
- Corporate Volunteer Strategy;
- Local Content Plan;
- Indigenous Participation Plan; and
- Recruitment and Training Strategy.

20.7 Conclusion

The mine development will result in benefits to the local and regional communities, as well as resulting in a number of social impacts. The SIA found that the most significant social impacts predicted to occur will accrue to residents in closest proximity to the mine project area, particularly within the settlement of Kings Plains. The potential significant opportunities associated with the mine development will accrue largely to the broader Blayney LGA.

The SIA found that the PAA, and particularly the Kings Plains locality, will experience a number of social impacts as a result of the construction and operations phases of the project. These impacts relate to a range of factors including changes in rural amenity and potential outmigration of residents. The most significant social impact of the mine development on the residents close to the project area will be elevated noise levels particularly during the first few years (up to Year 4) prior to the completion of the southern amenity bund, and a change in the landscape due to the construction of the waste rock emplacement and the removal of the top of McPhillamys Hill as the open cut is mined. As described in Chapter 6, Chapter 10 (noise) and Chapter 19 (visual), an extensive amount of work has been undertaken to ensure all reasonable and feasible measures have been implemented into the project design to avoid and/or reduce amenity related impacts on the Kings Plains community.

A range of mitigation measures have been proposed to mitigate and or manage the social impacts associated with the mine development.

The mine development will provide substantial direct and indirect employment opportunities, which will in turn provide a significant boost to the regional economy. The Blayney LGA in particular will benefit from investment in community infrastructure and services made possible through the a VPA, investment in education and training as Regis seeks to build a local skill base to support labour supply for the project, project procurement spend as Regis is committed to supporting local businesses to participate in the project procurement process, and direct and indirect population growth.

Chapter 21

Waste

REGIS RESOURCES LTD

21 Waste

21.1 Introduction

Waste will be managed in accordance with the requirements of the POEO Act, *Waste Avoidance and Resource Recovery Act 2001* (WARR Act), the *Protection of the Environment Operations (Waste) Regulation 2014,* the *Waste Classification Guidelines* (EPA 2014) and the *Waste avoidance and resource recovery strategy 2014-21* (EPA 2014). Regis will apply general waste minimisation principles such as reduce, reuse and recycle to minimise the quantity of waste that must be disposed off-site. No on-site rubbish disposal or landfill is proposed.

The EARs relevant to the mine (Table 21.1) require waste management from the construction and operation of the mine to be managed in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014* which provides a regulatory framework for the appropriate reporting, monitoring and management of wastes.

Table 21.1 Waste management related EARs for the mine development

Requirement	Where addressed
a tailings risk assessment based on the tailings composition and identification, quantification and classification of the potential waste streams likely to be generated during construction and operation, including and not limited to non-production wastes, reagent materials and cyanide compounds.	Non production waste: 21.2 and 21.3 Production waste: 2.7 and 2.9
description of the measures to be implemented to store, manage, reuse, recycle and safely dispose of these materials in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014*, including and not limited to operational water by-products, adequate spill detection and clean up systems, suitable locations for disposal or reuse of spoil generated during construction.	Non production waste: 21.2 and 21.3 Production waste: 2.7 and 2.9

21.2 Waste streams

Non-production waste streams are associated with both construction and operational project stages. Non-production waste streams will be managed as illustrated in Table 21.2. Production waste associated with mine operations is dealt with in Chapter 2a – Mine Development; 2.7 – Waste rock management and 2.9 – Tailings storage.

Table 21.2 Non-production waste stream and management for the mine development

Waste stream	Storage	Disposal
General waste	Bins located in the mine administration, workshop and other areas as required. These will be regularly emptied into large, centrally-located covered skip bins.	General waste will be regularly collected by an appropriately licenced contractor for off-site disposal at a facility approved to accept such waste.
General recyclables	Bins located in the mine administration, workshop and other areas as required. These will be regularly emptied into large, centrally-located covered skip bins.	Recyclables will be regularly collected by an appropriately licenced contractor and taken to a licenced facility.
Oil and grease	Waste oils and grease will be primarily limited to the routine maintenance of plant and	Oils and grease will be regularly collected by a licenced waste contractor for recycling and/or

Table 21.2 Non-production waste stream and management for the mine development

Waste stream	Storage	Disposal
	equipment will include parts and packaging (for example, cartridges, filters and waste oil drums). This waste will be stored in bunded containers in the workshop area and transferred to a centrally located bunded waste oil collection facility. Oily water from the workshop area and washdown bay areas will be collected in sumps or tanks and drained to an on-site oil-water separator.	off-site disposal at a waste facility approved to accept such waste. Licenced contractors will regularly service and maintain the separator and remove all waste hydrocarbons for recycling.
Batteries	Stored in a designated covered area.	Collected as necessary by an appropriately licenced contractor and recycled if possible.
Scrap steel/metal	Stored in designated scrap metal skip bins or specified areas.	Collected regularly by a scrap metal recycler
Tyres	Stored in designated tyre bins or specified areas.	Tyres will be regularly collected by an appropriately licenced contractor. Where possible, tyres will be collected from site by the supplier or reused on site where practicable for such uses as construction of retaining walls, erosion protection or traffic control.

21.3 Management and mitigation

Regis will prepare a waste management plan (WMP) which will describe mitigation measures to ensure non-production waste is reduced, reused or recycled where possible.

The follow mitigation measures will be implemented to manage non-production waste:

- waste streams will be classified and managed in accordance with the POEO Act, *Waste Avoidance and Resource Recovery Act 2001* and the *Waste Classification Guidelines* (EPA 2014);
- each waste stream will be appropriately segregated and stored as described in Table 21.2 prior to reuse, recycling or disposal;
- designated waste storage bins or areas or bins will be frequently inspected;
- designated waste storage bins and areas will be appropriately sign posted;
- site induction training for employees, contractors and visitors will include detail of where on site to correctly dispose of each non-production waste stream including mitigation measures to ensure non-production waste is reduced, reused or recycled where possible;
- performance in waste reduction and management, reuse, source separation and recycling initiatives will be tracked and reported; and
- waste disposal will be conducted by an independent appropriately licensed contractor.

Chapter 22

Closure and rehabilitation

REGIS RESOURCES LTD

22 Closure and rehabilitation

22.1 Introduction

This chapter provides a summary of the rehabilitation and closure strategy for the mine development, which is presented in full in Appendix U. The overarching objective of the rehabilitation strategy is to create safe, stable, and non-polluting post mining landforms that are consistent with agreed post mining land uses.

The rehabilitation strategy for the mine development has been prepared recognising that, if the project is approved, a mining operations plan (MOP) will be prepared and submitted to the DRG for approval prior to commencement. The MOP will be generally consistent with the commitments relating to rehabilitation and closure outlined in this chapter and the rehabilitation strategy in Appendix U. Further, the rehabilitation concepts presented in the strategy will be reviewed over time to allow for the consideration of a number of factors, including the outcomes of future rehabilitation trials and research, as well as the outcomes of consultation with relevant stakeholders during the detailed closure planning phase, which will occur within five years of planned closure. Final rehabilitation and project closure requirements will ultimately be formulated in consultation with key government agencies and other relevant stakeholders.

The EARs specified two requirements relating to rehabilitation and closure, requiring the preparation of a rehabilitation and landscape management strategy, as shown in Table 22.1.

Table 22.1 Rehabilitation related EARs for the mine development

Requirement	Where addressed
Key Issues: **Closure, Rehabilitation and Final Landform –** including a Rehabilitation and Landscape Management Strategy providing:	This chapter, and the Mine Development Rehabilitation and Landscape Management Strategy found in Appendix U. Rehabilitation of the pipeline is discussed in Chapter 35.
a detailed overview of the final land-use and closure criteria for the development, including both the mine and site and raw water pipeline; and	Section 22.4 (final land use) Section 22.7 (completion criteria)
identification and discussion of opportunities to improve rehabilitation and environmental outcomes for existing disturbed areas within the project site	The project is a greenfield development. The majority of areas within the project area that will not be disturbed by the mine development will continue to be used for agricultural purposes.

The mine development's Rehabilitation and Landscape Management Strategy (referred to as the rehabilitation strategy) was prepared in consideration of the appropriate legislation, guidelines, policies and industry requirements, including:

- *Guideline for mineral exploration drilling; drilling and integrity of petroleum exploration and production wells* (NSW Department of Industry, Skills and Regional Development - Division of Resources and Energy, March 2016);
- *ESG3 – Mining Operations Plan (MOP) Guidelines, September 2013* (NSW Department of Trade and Investment – Division of Resources and Energy, 2013);
- The *Strategic Framework for Mine Closure* (ANZMEC and MCA, 2000);
- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth of Australia, 2006); and

- *Mine Closure and Completion - Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth of Australia, 2006).

22.2 Rehabilitation and decommissioning objectives

The overriding objective of rehabilitation activities at the mine will be to return disturbed land to a condition that is stable, and supports the proposed post-mining land use, which is grazing on improved pasture in combination with some woodland areas. Specifically, the rehabilitation goals are:

- to remove all project-related infrastructure not required by the final land use;
- to restore a safe and stable landform;
- to reinstate the soil profile and function, creating landforms that are compatible with the surrounding topography; and
- to establish a landscape that permits the land use of livestock grazing on improved pasture, whilst also enhancing biodiversity values lost due to past agricultural clearing.

The rehabilitation strategy was developed in consideration of several factors including opportunities (such as proximity to remnant native vegetation areas) and constraints (such as slope and soil quality), ecological and rural land use values and existing strategic land use objectives. The rehabilitation objectives for the mine development are summarised in Table 22.2.

Table 22.2 Rehabilitation objectives for the mine development

Aspect	Objective
Mine site (as a whole)	• Safe, stable and non-polluting • Landforms designed to incorporate micro-relief and integrate with surrounding natural landforms • Constructed landforms that maximise surface water drainage to the natural environment (excluding the final void catchment) • Minimise visual impact of final landforms as far as is reasonable and feasible
Void	• Minimise water inflows at all times to prevent risk of discharge to surface waters • Minimise to the greatest extent practicable the safety risk to humans, stock and fauna
Rehabilitation areas and other vegetated land	• Establish self-sustaining native open woodland ecosystems characteristic of vegetation communities found in the project area (ie pre-mining) on the waste rock emplacement • Establish areas of self-sustaining riparian habitat, within the diverted clean water diversion channel
Agricultural land	• Reinstate targeted land and soil capability classes • Rehabilitate grassland areas so that they can support sustainable grazing activities
Clean water diversion channel(s)	• Engineered to be hydraulically and geomorphologically stable • Incorporate erosion control measures based on natural channel design principles • Revegetate with suitable native species
Surface infrastructure	• To be decommissioned and removed, unless agreed otherwise as part of the detailed closure planning process
Community	• Ensure public safety • Minimise adverse socio-economic effects associated with mine closure

22.3 Final landform and land use

22.3.1 Final landform

Post-mining, the key elements that will result in the most change in the landscape will be the open cut void, the waste rock emplacement, and the TSF.

At the completion of ore extraction, the open cut void will be a cone shaped hole, approximately 1,050 m across at its widest point, and 460 m deep. There will be no opportunity to progressively backfill the void due to the single pit configuration and any backfilling would prevent access to the orebody at depth. Reclaiming the waste rock to backfill the void after ore extraction has been completed would both prolong the duration of visual, noise and air quality impacts on sensitive receivers by a number of years and would render the project financially unviable. The open cut will therefore remain a void, as described further in Section 22.4.8.

In relation to the waste rock emplacement, and as described in Chapter 6, the design and scheduling of the waste rock emplacement was an iterative process in consideration of a number of factors, including:

- the encapsulation of PAF material;
- haulage distances;
- noise levels from its construction;
- the ability to progressively rehabilitate the landform;
- visual impacts; and
- the stability of the landform.

Erosion and landform evolution modelling was undertaken by Landloch (2019) to ensure the waste rock emplacement will be stable in the long-term. The modelling demonstrated that a traditional benched design waste rock emplacement is visually inconsistent with existing landforms due to the presence of linear drainage features and sharp corners and unlikely to be stable in the long-term.

The waste rock emplacement design was developed in part by using the Water Erosion Prediction Program (WEPP), SIBERIA and the Revised Universal Soil Loss Equation (RUSLE). SIBERIA is a 3-dimensional topographic evolution model that simulates runoff, erosion and deposition. It predicts the long-term evolution of channels and slopes within a landform and is used to map and quantify the rate of gully development. This provides a method for predicting how long the PAF cell would be protected from erosion within the waste rock emplacement.

The resulting adopted design of the emplacement is based primarily on the ability of the site soil and waste rock materials to withstand the critical shear stress from overland flows. The design includes the following key elements:

- linear gradient of 14 degrees;
- minimisation of flow concentration and therefore the erosion potential of run-off;
- smooth corners consistent with pre-existing and surrounding landforms;
- incorporation of ridge lines and minor drainage lines within the slope profile;

- incorporation of micro-relief and topographical features on the top of the emplacement (as can be seen in Figure 2.14 in Chapter 2); and

- the use of topsoil, vegetation and rock matrices where necessary to provide the required erosion protection on slopes and flow paths.

Further refinement of the waste rock emplacement design will be undertaken following detailed flume testing and rainfall simulation testing of site soils and waste materials during development of the MOP for the site.

The proposed TSF is a valley-style storage which will be formed by a primary embankment constructed across a valley, and the tailings slurry pumped into the area behind the embankment. The TSF will therefore progressively develop over the life of the mine as tailings are disposed of in the facility. The final surface of the TSF will be developed to create a tailings profile that is as flat as possible to maximise the effectiveness of the cap, and to create a low gradient generally free drainage final surface profile that minimises ponding.

The final landform is illustrated in Chapter 2 (Figure 2.14), and further discussion on rehabilitation of individual domains is discussed in Section 22.4. In addition, photomontages from various viewpoints around the project area which show what the final landform will look like are provided in Chapter 19 and in the visual assessment report in Appendix S.

22.3.2 Final land use

Land uses on properties surrounding the project area primarily comprise agricultural uses, forestry, rural residential and transport infrastructure (ie the Mid Western Highway). Consideration of final land use options took into account the current land uses in and surrounding the project area, infrastructure to be developed by the mine development, the achievable final landform, and the proximity of the mine to existing agricultural land uses, the town of Blayney, the settlement of Kings Plains, rural residences and general local infrastructure. The rehabilitation approach chosen is to reinstate the existing agricultural land-uses as much as possible while enhancing biodiversity values lost due to past agricultural clearing through the establishment of woodland areas on the steeper sections of the final landform.

As described in Chapter 7, the project area currently consists of mostly LSC class 4 and class 5 land, which is consistent with the historic land-use of growing naturalised pasture to support grazing by cattle and sheep. Post mining, the rehabilitated landform will be a combination of mainly class 4, class 5 and class 6 land. The mine development will result in a reduction of class 4 and 5 land by 12 ha and 411 ha respectively. The area of class 6, 7 and 8 land will increase by 336 ha, 17 ha and 70 ha, respectively. Despite the changes, the majority of the site will be suitable for the continuation of agricultural land use post mining, with the exception of the final void.

Notably, and as discussed in Chapter 7 (soil and land resources), the LSC class across parts of the TSF footprint will be improved from a pre-mining LSC class 5 to a post-rehabilitation LSC class 4. This commitment to rehabilitating the TSF final landform to achieve an LSC class of 4 means that there will be only a minimal change to the area of class 4 land (ie -12 ha) across the disturbance area as a result of the mine development. Proposed post mining land uses for each domain are summarised in Table 22.3 in the section below.

22.4 Rehabilitation domains

22.4.1 Overview

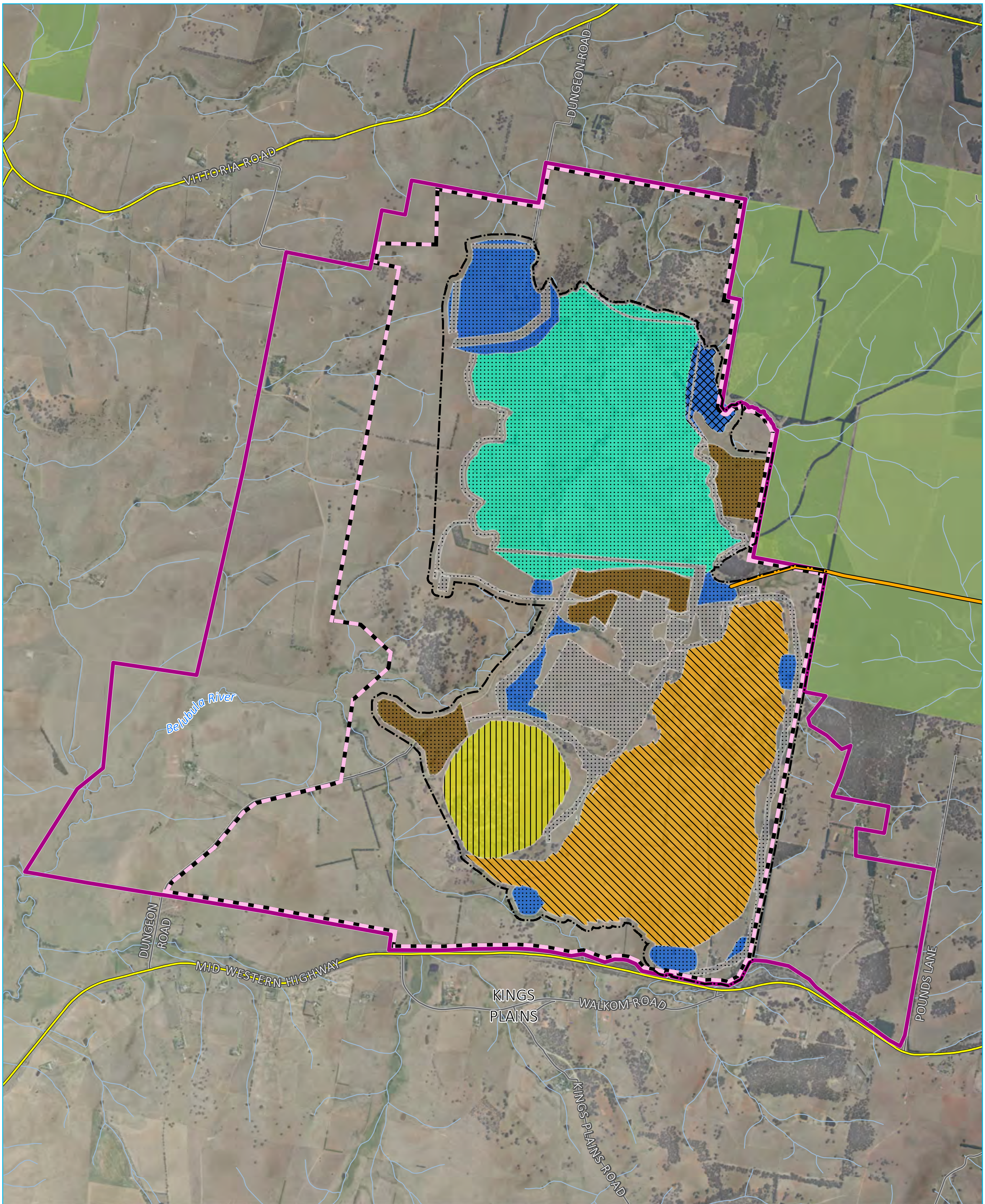
The project area has been divided into a series of primary closure domains, with each domain having similar bio-physical characteristics. These domains have been assigned in accordance with the requirements of the Department of Trade and Investment's guideline ESG3: *Mining Operations Plan Guidelines* (September 2013) (the MOP guidelines), so that they can be easily transferred into the MOP when it is prepared post-approval.

Primary domains (as defined in the MOP guidelines) are based on land management units within the project area, usually with a unique operational and functional purpose during operation and therefore have similar characteristics for managing environmental issues. The primary domains form the basis of conceptual rehabilitation and project closure planning for this strategy. Secondary domains are defined as land management units characterised by a similar post mining land use objective (DRE 2013).

The primary and secondary domains that have been identified for the project are listed in Table 22.3 and illustrated in Figure 22.1.

Table 22.3 Primary and secondary domains, and final land uses for the mine development

Code	Primary Domain (Operational)	Mine Areas included	Code	Secondary Domains (Post Mining Land Use)
1	Mine Infrastructure Areas	Administration office and amenities, carparking, processing plant, process and maintenance building, workshop, stores, ROM pad, ore stockpiles, haul roads and access roads, powerlines and water pipelines	D	Rehabilitation Area - Pasture LSC class 6
2	Tailings storage facility	Tailings Storage Facility	D	Rehabilitation Area - Pasture LSC class 4
3	Water management areas	Raw Water Dam, Primary WMF (process water dam), TSF Seepage Interception WMF, Secondary WMF and sediment dams (WSF1 to WSF4), TSF clean water diversion	D, B	Rehabilitation Area - Pasture LSC class 5 Riparian vegetation
4	Waste rock emplacement	Waste rock emplacement and pit amenity bund	E	Rehabilitation Area – Woodland (Primarily comprising Yellow Box - Blakely's Red Gum grassy woodland and Broad leaved Peppermint-Brittle Gum – Red Stringybark dry open forest)
5	Soil stockpiles	Topsoil stockpiles, subsoil stockpiles	D	Rehabilitation Area - Pasture LSC class 4 and 5
6	Open cut void	Final void	I	Final Void



Source: *EMM (2019); Regis Resources (2019); Survey Graphics (2019); DFSI (2017); ELVIS (2014)*

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY

Project application area
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Disturbance footprint
- Pipeline corridor

Existing environment
- Main road
- Local road
- Watercourse/drainage line
- Vittoria State Forest

Primary domains
- 1. Infrastructure area
- 2. Tailings storage facility
- 3. Water management area
- 4. Waste rock emplacement
- 5. Soil stockpile
- 6. Open cut void

Secondary domains
- B - Riparian vegetation
- D - Pastures
- E - Open woodland and open forest
- I - Final void

Primary and secondary rehabilitation domains

McPhillamys Gold Project
Environmental impact statement
Figure 22.1

22.4.2 Progressive rehabilitation

There will be opportunity to progressively rehabilitate the waste rock emplacement throughout the mine life, as well as the outer batter of the TSF embankment. Temporary revegetation of the pit amenity bund, water storage facility embankments, the ROM outer embankments, some road fill batters and soil stockpiles will also be undertaken when these pieces of infrastructure are establishment, for the purposes of dust control, stabilisation and visual amenity.

Rehabilitation of the south-eastern, southern and south-western slopes of the waste rock emplacement will be prioritised early in the mine life to provide erosion protection and to improve the visual amenity of the emplacement. As described in Chapter 2, the southern face of the waste rock emplacement will be constructed first and as quickly as possible (where weather conditions permit in consideration of noise criteria) to provide a noise and visual amenity bund for the residents of Kings Plains, to the south of the project area, and for traffic travelling along the Mid Western Highway. Further progressive rehabilitation of the waste rock emplacement will be undertaken as construction of the emplacement moves in a northerly direction.

The progressive rehabilitation of these outer slopes can be seen in the series of photomontages developed as part of the visual assessment and included in Chapter 19. The progressive rehabilitation of the emplacement can also be seen in the indicative staged mine plans provided in Chapter 2 (Figures 2.4a to 2.4e).

Further discussion on the planned rehabilitation of the primary domains is provided in the following sub-sections.

22.4.3 Domain 1 - Mine infrastructure areas

Following the cessation of mining, surface infrastructure will be safely decommissioned. Infrastructure items will be dismantled or demolished (depending on whether they will be re-used or recycled). Services will be disconnected and removed, and all concrete footings will be removed to around 1 m below ground level. If any contamination is found, then the area will be appropriately remediated so that it is suitable for the agreed future land use of grazing.

The majority of mine infrastructure areas will have relatively flat gradients, other than the outer batters of the ROM pad. It is possible that some infrastructure may be retained, such as hardstands and/or workshop buildings post mining for beneficial re-use subject to appropriate approvals; however, for the purposes of this strategy, it is assumed that all infrastructure will be removed.

Several roads and tracks could also be retained for use by future landowners. Agreement for ongoing use and management of roads will be sought with landholders or third parties. Some roads may also be temporarily retained following rehabilitation as access roads for rehabilitation monitoring purposes. This will be determined in consultation with stakeholders and council.

Most roads across in the project area will be highly compacted. Rehabilitation, where required, will accordingly require deep ripping, profiling, application of topsoil and seeding. Drainage will be constructed where necessary. Roads which are selected to remain post-mine closure may require sediment containment measures to minimise sediment entering waterways.

Power poles associated with the mine power supply will generally not require the excavation of pads for installation of footings, therefore will not require reshaping when they are removed.

The tailings pipeline will consist of a HDPE pipe located within a containment bund. The containment bund will be reshaped such that close to the pre-mining contours are re-established.

The clean water catchment to the north-east of the TSF will be piped through the plant area during mining operations. At closure, this will be removed, and a permanent diversion channel established that will be designed in accordance with natural channel design principles.

22.4.4 Domain 2 - Tailings storage facility

Geotechnical analysis has been undertaken to confirm the general suitability of the proposed TSF embankment. As a result, the TSF embankment has been designed with the following design features:

- external batter slope of 14°;
- internal batter slope of 26°;
- crest width of 15 m; and
- height of around 49 m.

The TSF will be operated such that tailings beaching will aim to achieve the final slope design to the maximum extent possible. This is undertaken to reduce the need to reshape tailings which can be challenging due to the bearing strength of the tailings and potential for liquefaction.

During the final decommissioning and rehabilitation phase, the tailings will be overlain by a capillary break layer of NAF waste rock, approximately 0.5 m thick. This rock will be primarily sourced from the Secondary WMF embankment, as well as other embankments that were established early in the mine life. Approximately 0.7 m growth media cover will then be placed across the TSF surface, consisting of approximately 0.6 m subsoil capped with 0.1 m topsoil, as illustrated in Figure 22.2. Prior to placing the topsoil, the cap will be allowed to settle and if necessary, additional subsoil placed to achieve the final landform design and required soil depth to achieve an LSC class of 4, followed by topsoil placement and revegetation with pasture species by either drill or broadcast seeding.

The final TSF landform will grade gently towards a clean water diversion to the south-east of the TSF embankment. Minor reshaping works may be required, and it may be necessary to install shallow grass lined drains to facilitate free draining on the landform to the permanent clean water diversion to the east of the TSF.

Further detail on the TSF is provided in Chapter 2 (project description) and Chapter 9 (water resources) with reference to seepage management from the TSF.

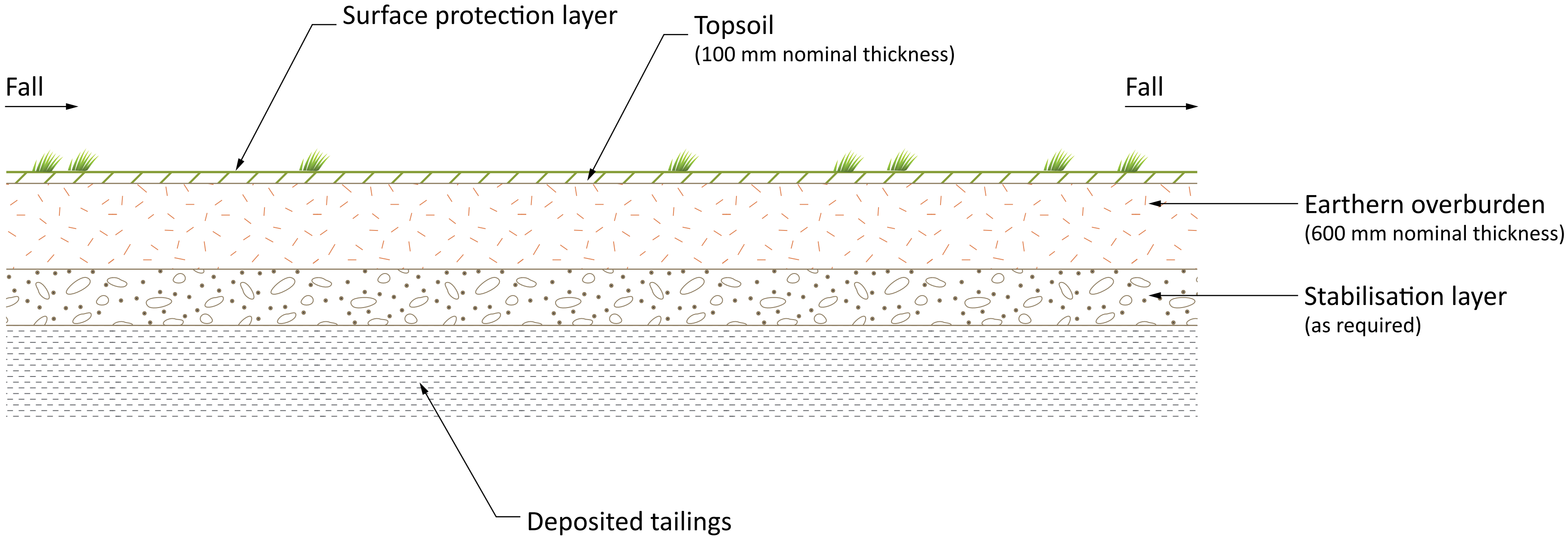
22.4.5 Domain 3 - Water management facilities

Other than the TSF clean water diversion embankment, all WMFs will be removed when no longer required during the rehabilitation phase. The rehabilitation process will involve dewatering, removal of any embankments, revegetation and monitoring. Specific rehabilitation works will vary depending on the storage history. WMFs that contained saline water or other contaminants such as the Primary WMF (used for process water) and the TSF Runoff Interception WMF, may require remediation. These dams will be dewatered once site discharge water criteria have been achieved and any contaminated sediment excavated and taken to the TSF or offsite to an appropriately licensed facility.

WMFs that have been used as sediment basins, such as WMF1 through to WMF4, may require treatment with suitable coagulants and/or flocculants, dewatering and backfilling once the accumulated sediment has been allowed to dry out.

Slope gradients will generally be in accordance with those that existed pre-mining. WMFs will be rehabilitated to a grazing post mine land use.

A clean water diversion drain will be constructed on the eastern side of the TSF. This diversion will convey clean water from upstream of the TSF around the south-eastern corner of the embankment, and into the Belubula River. The diversion channel will be constructed to mimic natural geomorphological features and will be seeded with cover crop and riparian species. Another clean water diversion to divert water around the north of the final TSF landform will be required. This will be designed as part of the development of the detailed mine closure plan, which will be required within five years of the end of project life.



Conceptual TSF capping arrangement

22.4.6 Domain 4 - Waste rock emplacement

As explained above, construction of the waste rock emplacement will commence in the south and will generally move a northerly direction. Progressive rehabilitation will therefore progress in the same direction. The southern end of the emplacement will be constructed as a priority in the first few years of the mine development to create a landform that provides both a visual and noise amenity bund.

Micro-relief has been incorporated into the final landform of the waste rock emplacement, as shown in Figure 22.1, so as to integrate the landform as much as possible into the surrounding landscape. Micro-relief elements include smooth corners, inclusion of ridge lines and minor drainage lines, small topographical features along the top of the emplacement to again integrate the landform into the surrounds, and notably, no benches or rock-lined drop structures. The final height of the waste rock emplacement, at its highest point, will be around 1,075 m RL. This is approximately 60 m higher than the current highest point in the natural landform within the waste rock emplacement footprint.

As described in Section 22.3.1, erosion and landform evolution modelling of the waste rock emplacement final landform was conducted by Landloch (2019), showing the landform to be long-term stable.

An open woodland is proposed across the waste rock emplacement, which will have an LSC class of 6, to:

- enhance the biodiversity and visual amenity of the project area;
- protect the integrity of the PAF cells within the waste rock emplacement from the erosion risks associated with poorly managed grazing practices; and
- enhance the function of the store and release cover by establishing trees that maximise evapotranspiration of water stored in the soil.

22.4.7 Domain 5 - Soil stockpiles

Subsoil and topsoil will be stripped for capping and rehabilitation purposes. Soil stockpiles will be located on relatively flat areas that will not require modification. There is also opportunity to store soil within the footprint of the waste rock emplacement nearby where it is to be spread, which will avoid potential double handling of material. It is anticipated that all soil will be removed from the stockpiles during the rehabilitation phase of the mine development and pasture will be re-established at soil stockpile locations.

22.4.8 Domain 6 - Final void

As described in Section 22.3.1 the final void will be approximately 460 m deep. In the competent rock areas, the void will have side slopes of 40 to 45°. The void has been designed with the steepest possible geotechnically stable sides to economically access the ore body and minimise the generation of waste rock.

Minimal modification to the final void landform is anticipated during the rehabilitation phase, other than battering back upper batters of the void where soil and weathered rock are present and the construction of a safety bund and security fence around the top. The upper benches where soil is present will be battered back to a gradient that topsoil can be placed on (< 27°) and any dispersive soils treated with gypsum. These upper benches will then be topsoiled and seeded with grass species.

The safety bund will be constructed approximately 2 m high with 27° batters. The bund will be topsoil and seeded with cover crops and open woodland species. A barbed wire fence will be constructed in front of the bund to prevent stock access.

As described in Chapter 9 (water resources), the final void is anticipated to be a sink, which means that groundwater will accumulate in the void over time until an equilibrium water level is reached. HEC (2019) modelled this level to be more than 9 m below the spill level (ie it will not spill); also finding that this equilibrium level will be reached very slowly over a period of approximately 400 years. Under predicted long-term steady state conditions, the pit lake will remain predominantly a sink even after 500 years. After equilibrium is reached inflow to the void is predicted to remain the primary flow path of water (approximately 97%) in the vicinity of the open cut and a very minor volume (approximately 3%) is predicted to slowly seep back into the groundwater resources within close proximity of the open cut. In relation to final void water quality, salinity levels in the void will increase slowly over time as a result of evapo-concentration.

22.5 Rehabilitation methods

22.5.1 Soil management

Topsoil and subsoil stripping plans will be developed for each area prior to soil disturbance. As part of this process, a Land Disturbance Permit system will be implemented to ensure that clearing activities are managed appropriately. A soil stripping and placement plan will be incorporated into the Land Disturbance Permit for each stripping event.

Prior to stripping, soil sampling will be undertaken to determine if the soil requires amelioration to ensure the soils physical and chemical characteristics are within ranges necessary to address any erosion or revegetation constraints posed by the soils. Detailed soil management measures to be implemented on the site, including in relation to soil stripping, stockpiling and re-spreading, are described in Chapter 7 (soil and land resources) and in Appendix H.

A soil plan will also be incorporated into the Rehabilitation Management Plan to identify where the stripped soil will be placed, based on its suitability for reuse and the soil balance. Suitability will be determined following soil testing. Soil stockpile locations, volumes and date of soil stripping will be recorded as part of the Rehabilitation Management Plan.

22.5.2 Establishment of vegetation

Vegetation species for rehabilitation purposes is anticipated to consist of:

- cover crop species for short term erosion protection and weed suppression;
- introduced pasture species for stabilisation of the waste rock emplacement and TSF embankments, long-term soil stockpile protection and rehabilitation for grazing purposes;
- species that comprise the vegetation communities currently present within the project area: Broad-leaved Peppermint-Brittle Gum – Red Stringybark dry open forest, Yellow Box - Blakely's Red Gum grassy woodland and Mountain Gum-Manna Gum open forest species where a woodland is to be re-established (ie on the waste rock emplacement and pit amenity bund); and
- riparian species for the clean water diversions.

Seed for cover crop and pasture species will be obtained from commercial suppliers. Collection of native seed has commenced on site and will continue. Given the limited availability of open woodland on site for seed collection and the significant reductions in seed viability that can occur when seed is stored, purchase of additional seed from commercial suppliers is anticipated. Seed will be stored in a humidity controlled and vermin free environment to maximise its viability.

A number of sowing methods will be employed at the mine. These may include:

- hand seeding;
- drill seeding;
- broadcast seeding; and
- hydroseeding.

Hand seeding is likely to be used on small areas or where machinery access is difficult such as topsoil and subsoil stockpiles. Drill seeding is likely be used for the establishment of cover crop and pasture species of flatter areas up to approximately 14°. Broadcast seeding is likely to be used to sow natives on the top of the waste rock emplacement where gradients are flatter. This will be followed by harrowing using pasture harrows to lightly cover the seed with soil to ensure intimate soil contact.

On the slopes of the waste rock emplacement native seed will be sowed using a hydro-seeder followed by the application of a straw-based hydro-mulch and hydro-colloid binder to protect the seed and soil from compaction and erosion by rainfall and erosion from overland flow.

Rehabilitation monitoring will be carried out throughout the mine life, as will be detailed in the MOP, to monitor the progress of vegetation establishment over time, and to identify and implement remediation measures as necessary to enhance vegetation establishment.

22.5.3 Fauna and habitat enhancement measures

Bush rock and tree debris will be retained from land clearing and stripping activities for placement on the waste rock emplacement to provide erosion protection and habitat enhancement for small invertebrates and reptiles. Cleared timber may also be placed on the slopes on the contour and track rolled to ensure intimate soil contact and to minimise the concentration of flow under the timber.

22.5.4 Erosion and sediment control

An assessment of soil erosion hazard was included in the Rehabilitation and Landscape Management Strategy (refer to Appendix U) in accordance with the requirements of the Blue Book (Landcom 2004 and DECWW 2008) and was found to range from very low to very high.

The key erosion risks for the mine development are:

- highly erodible dispersible and/or non-cohesive subsoils;
- steep and long slopes on the waste rock emplacement and pit amenity bund; and
- duration of exposed soils.

The majority of the disturbed areas within the project area will report to WMFs that will function as Type D/F sediment basins (which are basins designed to effectively capture and treat dispersive soils), such that any eroded sediments will be contained (up to and including the design storm event). Detailed discussion on the water management system is provided in Chapter 2 (project description) and Chapter 9 (water resources). During the decommissioning and closure phase, the WMFs will be maintained until around 70% soil surface cover has been achieved on the rehabilitated surfaces and/or runoff meets the nominated water quality criteria.

Dispersive and non-cohesive soils will be managed in accordance with the methodologies described in Chapter 7, including the blending of non-cohesive sandy subsoil with high clay subsoil and gypsum treatment of dispersive subsoils.

The waste rock emplacement slope design has been modelled using WEPP and SIBERIA to determine stable slope designs and slope treatments to withstand the critical shear from overland and concentrated flows. The emplacement design considered the erosivity of site rainfall (relatively low), site soils (high) and the erosion protection that can be provided by effective revegetation of the emplacement slopes. Landloch (2019) considers that annual average erosion rates of less than 2t/ha/yr and a peak erosion rate of less than 5t/ha/yr can be achieved on the waste rock emplacement, meaning that the erosion hazard associated with the emplacement is very low.

Rehabilitated disturbed areas will be progressively rehabilitated as quickly as possible to minimise the risk of erosion and re-work, as illustrated by the staged progressive mine plans provided in Chapter 2.

A surface water management plan will be prepared for the mine development, which will include an erosion and sediment control plan. Progressive erosion and sediment control plans will then be prepared for discrete areas of disturbance as required.

22.5.5 Weed management

The presence of weed species has the potential to have a major impact on revegetation outcomes and therefore weed management will be an important component of rehabilitation activities.

The spread of declared noxious weeds (and other invasive weeds that could impact revegetation success and/or plants that are undesirable to grazing stock) will be managed across the project area through a series of control measures, including:

- herbicide spraying or scalping weeds;
- post-mining use of rehabilitated areas as a working farm, with associated management practices; and
- rehabilitation inspections to identify potential weed infestations.

22.5.6 Public safety

Controls will be implemented to minimise the potential for risks to public safety during the decommissioning and closure phase. This may include the erection and maintenance of fencing and warning signs around areas that have the potential to cause harm and that are accessible to the public, most notably the final void.

22.6 Rehabilitation trials, monitoring and post closure maintenance

Rehabilitation monitoring will be undertaken using analogue sites, and an accepted monitoring methodology such as Landscape Function Analysis (LFA), to assess rehabilitation progress and success. LFA is a methodology used to assess key indicators of ecosystem function, including landscape organisation and soil surface condition as measure of how well the landscape retains and uses resources. It was developed by CSIRO scientists Tongway and Hindley (Tongway 1994, Tongway and Hindley 1995, 1996, 2003, 2004). The indicators used quantify the utilisation of landscape resources of water, topsoil, organic matter and perennial vegetation in space and time.

An annual rehabilitation report will be prepared, and a summary of this report will be included in the Annual Environmental Management Report (or Annual Review). A combination of LFA and agricultural productivity analysis is an appropriate and generally accepted rehabilitation monitoring methodology for demonstrating the success of rehabilitation works and providing meaningful guidance where intervention is required.

However, the specific monitoring methods to be applied in the project area will be determined in the rehabilitation management plan and will be flexible in consideration of advancing technologies and changes to industry best practice.

Data obtained from the analogue sites will provide a range of values from replicated examples of similar vegetation communities. Rehabilitation areas are compared to reference sites that best represent the final land use, vegetation community and management conditions they will be subjected to. This approach allows the recognition of the dynamic nature of ecosystems, and therefore rehabilitation sites will be monitored simultaneously with the reference sites over time to account for changes in:

- seasonal variations
- climatic conditions
- management practices; and
- unexpected disturbance events such bushfire.

In order to demonstrate rehabilitation success or progression toward rehabilitation success, specific indicators will be expected to equal or exceed values obtained from the reference site under the same set of conditions or demonstrate a positive trend towards target values.

With the exceptions of domains 5, 6 and 7, all other primary domains will have a grazing post mining land use. Grazing productivity parameters will therefore be included in the rehabilitation monitoring program.

Rehabilitation monitoring will inform areas requiring maintenance and identify and address deviations from the expected outcomes. Rehabilitated areas will be assessed against performance indicators (refer to Section 22.7) and regularly (at least on an annual basis) inspected for the following aspects:

- evidence of any erosion or sedimentation;
- success of initial establishment cover;
- natural regeneration of improved pasture;
- weed infestation (primarily noxious weeds, but also where rehabilitation areas are dominated by other weeds);
- integrity of graded banks, diversion drains, waterways and sediment control structures; and
- general stability of the rehabilitation areas.

Where rehabilitation criteria have not been met, maintenance works will be undertaken. This may include the following:

- re-seeding and, where necessary, re-soiling and/or the application of specialised treatments;
- use of materials such as composted mulch to areas with poor vegetation establishment;

- replacement of drainage controls if they are found to be inadequate for their intended purpose, or compromised by vegetation or wildlife; and
- de-silting or repair of sediment control structures.

22.7 Completion Criteria

Rehabilitation completion criteria will be used as the basis for assessing when rehabilitation of the project area is complete. Indicators will be measured against the criteria, and are set for the six phases of rehabilitation, consistent with ESG3 as follows:

- Phase 1 – Decommissioning (ie removal of equipment and infrastructure);
- Phase 2 – Landform Establishment (ie land shaping);
- Phase 3 – Growth Medium Development (ie soil physical and chemical properties);
- Phase 4 – Ecosystem and Land Use Establishment (ie vegetation establishment);
- Phase 5 – Ecosystem and Land Use Sustainability (ie established vegetation is supporting post-mining land use); and
- Phase 6 – Land Relinquishment.

Interim rehabilitation criteria for the project have been developed with the current knowledge of rehabilitation practices and success in similar project environments. They consist of a set of objectives, rehabilitation criteria and evidence that criteria have been met using LFA and agricultural productivity measures. The criteria will be refined and confirmed in the MOP and in the detailed closure plan as the mine development progresses towards closure.

The rehabilitation criteria need to demonstrate that the rehabilitation objective has been achieved. Consequently, interim rehabilitation criteria are presented in Tables 22.4, 22.5 and 22.6 that address the following outcomes:

- restoration of a safe and stable landform that is non-polluting; and
- reinstate soil profiles and function and create landforms that are compatible with surrounding topography; and reestablishment of landforms that permit grazing, improved pasture and biodiversity outcomes.

Table 22.4 provides rehabilitation criteria applicable to both grazing and biodiversity post mine land uses. Table 22.5 provides rehabilitation criteria applicable to grazing only and Table 22.6 provides rehabilitation criteria application to biodiversity only. Reporting on rehabilitation activities, monitoring and progress towards achieving agreed rehabilitation criteria will occur in the Annual Review.

Table 22.4 Preliminary rehabilitation performance indicators and completion criteria for the mine development

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Landform establishment and stability	Landform slope, gradient	Landform suitable for final land use and generally compatible with surrounding topography	Slope angles consistent with design
	Landform function	Landform is functional and	Landscape Function Analysis

Table 22.4 Preliminary rehabilitation performance indicators and completion criteria for the mine development

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
		indicative of a landscape on a trajectory towards a self-sustaining ecosystem	(LFA) Stability; LFA Infiltration; LFA Nutrient Cycling; and LFA Landscape Organisation
	Active erosion	Areas of active erosion are limited	Number of rills/gullies; cross-sectional area of rills/gullies; presence/absence of sheet erosion; presence/absence of tunnel erosion.
Growth medium development	Soil chemical and physical properties and amelioration	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH; Electrical Conductivity; Organic Matter; Phosphorus; Nitrate; Cation Exchange Capacity; and Exchangeable Sodium Percentage, Mg and Al
		Soil contaminant levels are suitable for post mine land use	TPH, metals, chemicals

Table 22.5 Grazing rehabilitation performance indicators and completion criteria for the mine development

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Pasture establishment	Pastures established equivalent to analogue pastures sites	Pastures contains a diversity of species comparable to analogue pastures	Native and introduced pasture species richness;
		Number of weeds species and surface area cover ≤ analogue site	Diversity and percentage cover of weed species
Pasture development	Protective ground cover	Ground layer contains protective ground cover and structure comparable to that of the local pasture analogue	Litter cover; foliage cover; annual plants; cryptogam cover; rock; log; bare ground; perennial plant cover (0.5m); total ground cover
	Ground cover diversity	Pasture contains a diversity of species per square metre comparable to that of the local remnant vegetation	Native understorey abundance; exotic understorey abundance
		Number of weeds species and surface area cover ≤ analogue site	Diversity and percentage cover of weed species
Pasture stability	Pasture health	Pasture condition is comparable to that of analogue pastures	Live plants, healthy plants, pest infestation
	Pasture productivity	Pasture productivity equivalent to analogue pastures	Carrying capacity DSE/ha Crude protein % Digestibility % Green/dry matter content

Table 22.6 Biodiversity rehabilitation performance indicators and completion criteria for the mine development

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Ecosystem establishment	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Diversity of shrubs and juvenile trees; total species richness; native species richness; exotic species richness
	Vegetation density	Vegetation contains a density of species comparable to that of the local remnant vegetation	Density of shrubs and juvenile trees
	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees; shrubs; sub-shrubs; herbs; grasses; reeds; ferns; aquatic
Ecosystem development and habitat complexity	Protective ground cover	Ground layer contains protective ground cover and structure comparable to that of the biodiversity analogue	Litter cover; foliage cover; annual plants; cryptogam cover; rock; log; bare ground; perennial plant cover (0.5m); total ground cover
	Ground cover diversity	Vegetation contains a diversity of species per square metre comparable to that of the local remnant vegetation	Native understorey abundance; exotic understorey abundance
		Native ground cover abundance is comparable to that of the local remnant vegetation	Percent ground cover provided by native vegetation
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	Shrubs and juvenile trees 0-0.5 m in height; Shrubs and juvenile trees 0.5-1 m in height; Shrubs and juvenile trees 1-1.5 m in height; Shrubs and juvenile trees 1.5-2 m in height; Shrubs and juvenile trees >2.0 m in height
Ecosystem stability	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5-2 m; foliage cover 2-4 m; foliage cover 4-6 m; foliage cover >6 m
	Tree diversity	Vegetation contains a diversity of maturing tree and shrub species comparable to that of the local remnant vegetation	Tree diversity
	Tree density	Vegetation contains a density of maturing tree and shrub species comparable to that of the local remnant vegetation	Tree density; average diameter at breast height
	Ecosystem health	The vegetation is in a condition comparable to that of the local remnant vegetation	Live trees; healthy trees; medium health; advanced dieback; dead trees; mistletoe; flowers/fruit (trees)

22.8 Conclusion

The proposed 1,135 ha of disturbed land for mining and infrastructure use will be rehabilitated to a range of LSC classes, from class 4 to class 8. The majority of rehabilitation will target an agricultural (grazing) final land use. The upper slopes of the final void will be battered back to ensure a safe and stable landform remains post mining.

Progress on rehabilitation will be monitored annually and the results will be reported within the annual review. Final rehabilitation and closure requirements will ultimately be developed as part of a detailed closure plan, which will be produced within five years of closure in consideration of input from key government agencies, relevant stakeholders (including the nearby community) and applicable guidelines and standards at the time.


Part E

Impact assessment - pipeline development



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Chapter 23

Soil and land resources

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23 Soil and land resources

23.1 Introduction

This chapter presents an assessment of the potential impacts on soil and land resources associated with the construction and operation of the pipeline development. A desktop assessment of available information, including the results of database searches, was conducted to identify potential impacts which may arise due to the construction methodology of the pipeline and associated infrastructure.

The specific EARs relating to soil and land resources relevant to the pipeline development are shown in Table 23.1.

Table 23.1 Land and soil related EARS - pipeline development

Requirement	Where addressed
Land – including an assessment of:	
the likely impacts of the development on the soils and land capability of the site and surrounds, and a description of the mitigation and management measures to prevent, control or minimise impacts of the development;	Sections 23.3 and 23.4.
the likely agricultural impacts of the development, including identification of any strategic agricultural land;	Section 23.3.3
the likely impact of the development on landforms (i.e. local topography), including the long term geotechnical stability of any new landforms proposed on site; and	Section 23.3.1
the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007,* paying particular attention to the agricultural land use in the region;	Section 23.3.
Water – including: A description of construction erosion and sediment controls, how the impacts of the development on areas of erosion, salinity or acid-sulphate risk, steep gradient land or erodible soils types would be managed and any contingency requirements to address residual impacts	Sections 23.3 and 23.4

23.2 Existing environment

Existing information on soil and land resources within the pipeline corridor and surrounds was sourced via a desktop assessment from regional mapping published by various government departments. The relevant information has been summarised and presented in the following section. A more detailed description of the existing soil and land resources along the pipeline corridor is presented in Appendix W.

23.2.1 Soil landscapes

OEH has provided mapping of the soil landscapes of Central and Eastern NSW based on 1:100,000 and 1:250,000 topographic sheets. The mapping identifies 21 soil landscapes within the pipeline corridor.

The dominant soil landscapes in the approximate 127 ha pipeline corridor include the Bathurst (37 ha), Raglan (20 ha) and Sunny Corner (12 ha). Together, these soil landscapes make up over half of the pipeline corridor and typically contain undulating to rolling hills, with fixed to convergent drainage patterns. The dominant land use is livestock grazing of native and improved pastures on duplex soils.

Figure 23.1 shows the distribution of the soil landscapes in the pipeline corridor. Table W.1 and Table W.2 in Appendix W provides a summary of the soil landscapes along the pipeline corridor, comprising landscape characteristics, current land use, soils, vegetation, and erosion susceptibility.

23.2.2 Australian soil classification

The Australian Soil Classification (ASC) scheme (Isbell 2016) is a multi-category scheme with soil classes defined on the basis of diagnostic horizons and their arrangement in vertical sequence as seen in an exposed soil profile. The pipeline corridor is dominated by duplex soils, predominantly Chromosols (37 ha) in the area from Brewongle to Evans Plains Creek; Sodosols (27 ha) in the Brewongle area; and Kurosols (13 ha) generally in the eastern section from Angus Place to Yetholme. Kandosols (19 ha) are located in the Sunny Corner area, and Rudosols (11 ha) typically located along alluvial areas.

Figure W.1 in Appendix W illustrates the spatial distribution of the soil types in the pipeline corridor and Table W.3 provides a description of each ASC, and the extent of area covered within the pipeline corridor.

23.2.3 Land and soil capability

The land and soil capability (LSC) classes of land within the pipeline corridor have been identified using regional scale mapping provided by OEH. The LSC mapping classes are in accordance with the descriptions of the LSC assessment scheme (OEH 2012).

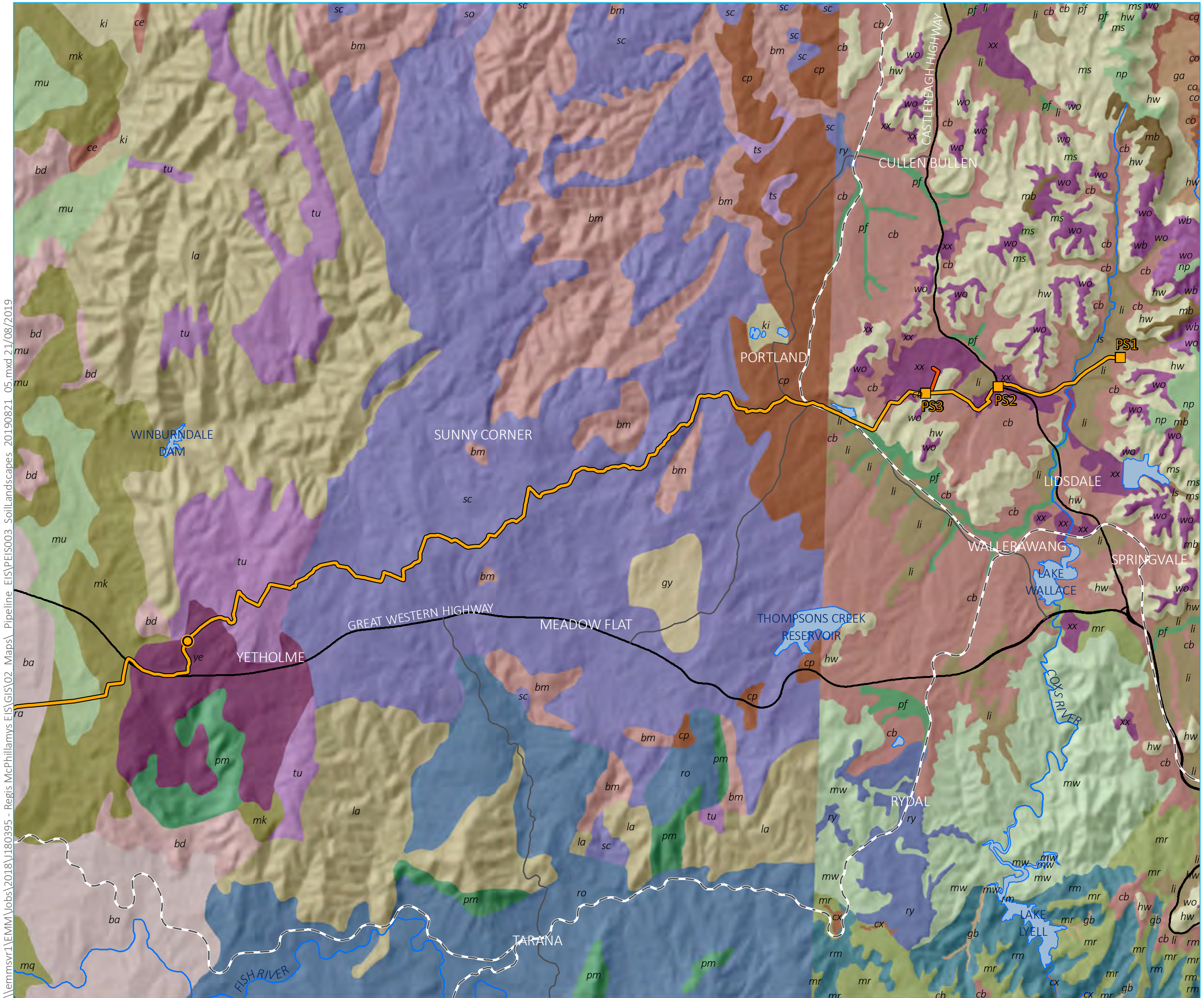
The pipeline corridor is predominantly Class 5 (73 ha, 58 %) and Class 3 (20 ha, 16 %) land, with 14 ha of Class 4. These LSC Classes are typically considered moderately low (Class 5) to high (Class 3) capability land and are generally consistent with livestock grazing with improved pastures, with possible regular cultivation in Class 3 land. There are also small areas of Class 2 (4 ha), Class 6 (5 ha), Class 7 (1 ha) and Class 8 (1.5 ha).

Figure W.2 in Appendix W shows the spatial distribution of the LSC classes along the pipeline corridor. The LSC class definitions are provided in Table W.4 in Appendix W along with the extent of each class mapped in the pipeline development.

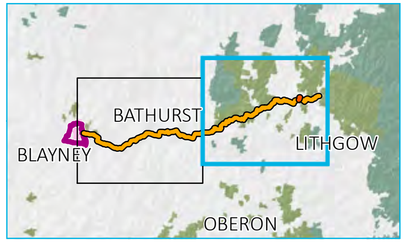
23.3 Soil salinity

The soil salinity potential of land within the pipeline development was reviewed with reference to OEH hydrogeological landscape (HGL) mapping and reporting (OEH 2019). The HGLs are mapped in Figure W.3 in Appendix W and a summary of the data sheets relating to each hydrogeological landscape is set out in Table W.6 in Appendix W. It is noted that the eSpade mapping does not cover the western most part of the pipeline corridor (about 460 m). That part of the pipeline is through the State Forest immediately east of the mine project area.

The mapping indicates approximately 9 ha (7%) of the pipeline corridor has high salinity and salt export impact potential. Approximately 21 ha (17%) of the pipeline corridor has a high or very high overall hazard. Approximately 24 ha (19%) of the pipeline corridor has a high erosion hazard.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2016); GA (2011)



KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Soil landscape

- ba - Bathurst
- bd - Burrendong
- bm - Blackbutt Mountain
- cb - Cullen Bullen
- ce - Canomodine
- cg - Canobla Gap
- co - Coco
- cp - Capertee
- cx - Coxs River
- ga - Glen Alice
- gb - Ganbenang
- gy - Gately Rocks
- hw - Hassans Walls
- ki - Killonbutta
- la - Lambie
- li - Lithgow
- ls - Long Swamp
- mb - Medlow Bath
- mk - Mookerawa
- mq - Macquarie
- mr - Marrangaroo
- ms - Mount Sinai
- mu - Mullion Creek
- mw - Mount Walker
- np - Newnes Plateau
- pf - Pipers Flat
- pm - Pine Mountain
- rm - Round Mount
- ro - Rocks
- ry - Rydal
- sc - Sunny Corner
- so - Sofala
- ts - Three Sisters
- tu - Turonfels
- wb - Warragamba
- wo - Wollangambe
- xx - Disturbed Terrain
- ye - Yetholme

Soil landscapes in the pipeline corridor

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Environmental impact statement
Figure 23.1a

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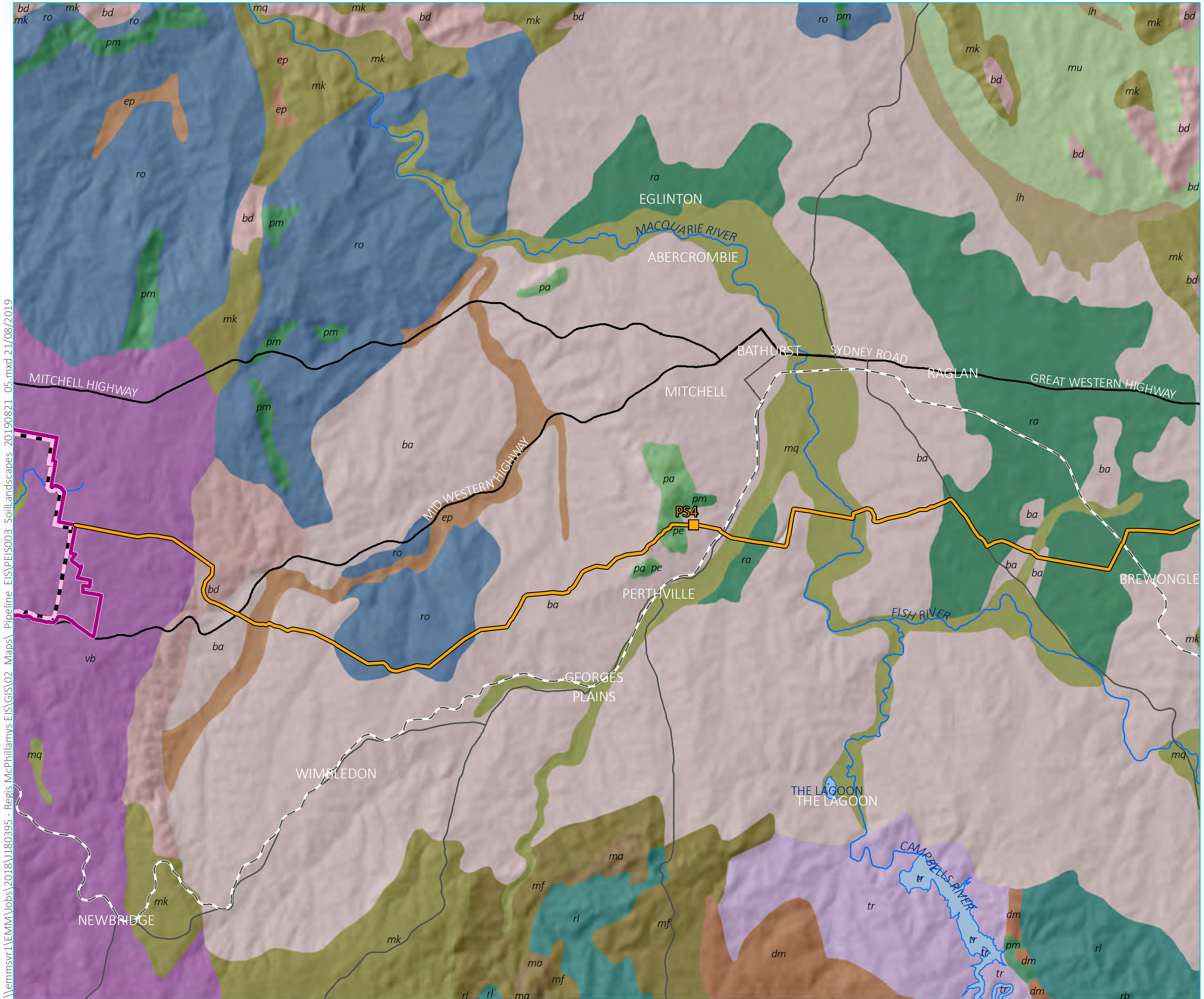

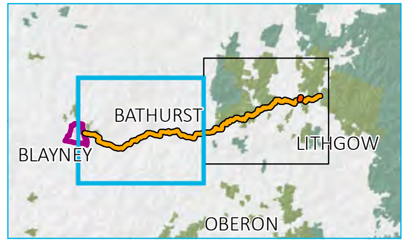

KEY

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- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Soil landscape

- ba - Bathurst
- bd - Burrendong
- dm - Duckmaloi
- ep - Evans Plains
- lh - Lachlan
- ma - Mount Airey
- mf - Mayfield
- mk - Mookerawa
- mq - Macquarie
- mu - Mullion Creek
- pa - Panorama
- pe - Pinnacle
- pm - Pine Mountain
- ra - Raglan
- rb - Razorback
- rl - Rockley
- ro - Rocks
- tr - Trunkey
- vb - Vittoria-Blayney

Source: EMM (2019); Regis Resources (2019); DFSI (2017); OEH (2016); GA (2011)

Soil landscapes in the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 23.1b

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23.3.1 Biophysical strategic agricultural land

BSAL is land with a rare combination of natural resources highly suitable for agriculture. The proposed pipeline development passes through 4.5 ha of land mapped by OEH as BSAL land, as shown in Figure W.4 contained in Appendix W. This BSAL land coincides with the areas of the Macquarie Soil Landscape around Saltwater Creek at Tarana Road, the Macquarie River and Queen Charlottes (Vale) Creek near Orton Park. It is mapped as LSC Class 2 (very high capability land).

Although the pipeline development will cross a small portion of BSAL mapped land, a site verification certificate or gateway certificate is not required because the pipeline development is wholly outside of the proposed mining lease application area for the project.

23.3.2 Acid sulfate soils

There are no acid sulfate soils or potential acid sulfate soils along the pipeline corridor, as per the *Guidelines for the Use of Acid Sulfate Soil Risk Maps* (DLWC 2000). The NSW OEH Acids Sulphate Risk Map (OEH 2018) indicates that the nearest site with a high probability of occurrence of acid sulfate soil is further than 60 km from the eastern extent of the pipeline corridor.

23.3.3 Contaminated soils

A search of the EPA Contaminated Land: Record of Notices within the Lithgow, Bathurst and Blayney LGAs found no registered contaminated sites within 1 km of the pipeline corridor.

The pipeline corridor passes through or close to the following sites which are identified in the NSW OEH contaminated sites notified to the EPA:

- Angus Place Colliery, Wolgan Road Lidsdale;
- Mount Piper Extension Development Site, 2847 Boulder Road Blackmans Flat;
- Lamberts Gully Mine, Castlereagh Highway Blackmans Flat;
- Ivanhoe Colliery, Pipers Flat Road Portland; and
- Mt Piper Power Station, 350 Boulder Road Portland.

Each site is identified as "Regulation under CLM Act not required", meaning that the EPA has completed an assessment of the contamination and decided that regulation under *the Contaminated Land Management Act 1997* is not required.

Further information regarding previous environmental site assessments carried out at the above locations is contained in Appendix W. These assessments concluded that the land was suitable for commercial, industrial or mining land use.

23.3.4 Naturally occurring asbestos

Naturally occurring asbestos is found in some rocks, sediments and soils, but is not common in NSW. Although harmless if not disturbed, work and activities can release asbestos fibres into the air which if inhaled can cause damage to health. The naturally occurring asbestos has been mapped in NSW and is restricted to narrow strips of land. There is a low potential of naturally occurring asbestos in the western most portion of the pipeline corridor, near the proposed mine site, as indicated in Figure 23.2.

23.4 Impact assessment

The construction of the 90 km pipeline development will principally be via open trench (except where there will be underboring beneath perennial creeks, rivers, railway lines and major/main roads). This will involve soil excavations approximately 1 m wide and ranging from 1.3 m to 2 m deep with a minimum cover of the pipe of 0.8 m. Following excavation, soil will be stockpiled, pipe will be laid, and then displaced soil will be used to backfill the trench. There will be vehicle traffic along the pipeline corridor and land access points.

The area that will be directly impacted by construction activities within the pipeline corridor will range in width from 6 m, such as along forestry tracks, to 20 m in open farmland, depending on a range of factors such as presence of significant vegetation, constructability, construction management and safety considerations, landform, slopes and anticipated sub-soil structures. The final disturbance zone within the pipeline corridor will be confirmed during detailed design; however this assessment considers the total pipeline corridor as a worst case scenario.

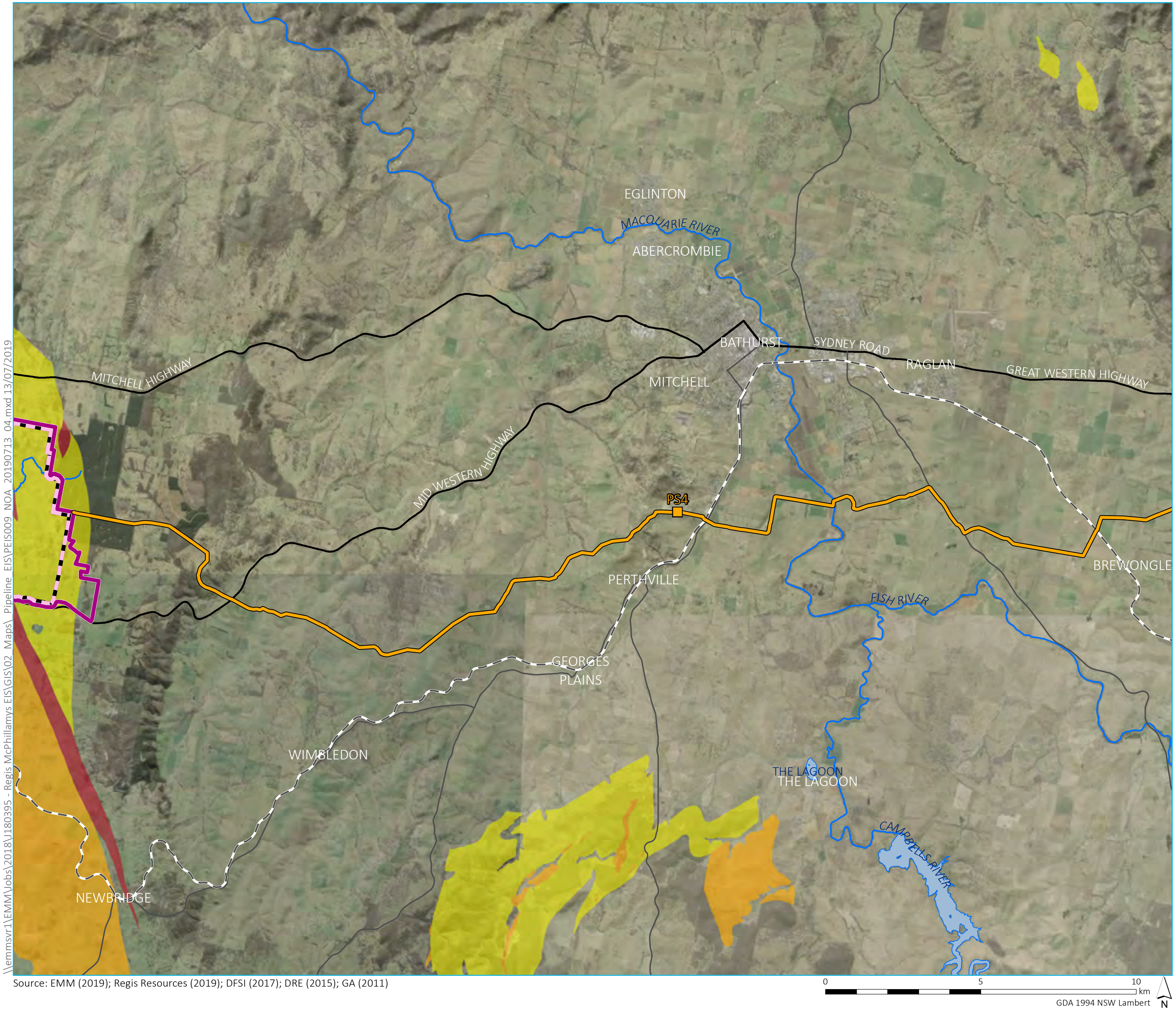
23.4.1 Erosion and sedimentation

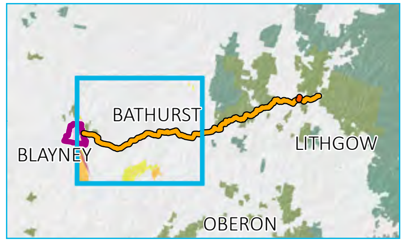
Stripping and stockpiling of soils potentially exposes the soils to the increased risks of wind and water erosion during the active construction period. Vehicle traffic movements within and to the construction sites have the potential to disturb soils with consequent possible erosion impacts. There is a risk of erosion and sediment transport which could affect the land's productive capacity and cause sedimentation downstream.

The potential erodibility of the soils is described in Tables W.1 and W.6 in Appendix W and is influenced by the soil type and the steepness of the topography. The soils in the pipeline corridor that have the greatest erosion potential are dispersive soils with an exchangeable sodium percentage of >4% and non-cohesive soils. Dispersive and potentially dispersive subsoils are likely to be present in the Cullen Bullen, Lithgow, Capertee, Sunny Corner, Yetholme, Mookerawa, Mullion Creek, Raglan, Rocks and Vittoria Blayney soil landscapes. Non-cohesive (sandy) soils are likely to be present around watercourses, ridge lines and colluvial slopes. As some of the land through which the pipeline corridor passes is of moderate to high erosion hazard, there is the possibility of erosion and downstream sedimentation if not managed appropriately.

Prior to the pipeline development construction commencing an Erosion and Sediment Control Plan (ESCP) will be prepared. Controls will be installed and maintained in accordance with the *NSW Soils and Construction – Managing Urban Stormwater Volume 1 "the Blue Book"* (Landcom 2004) and *Volume 2* (DECC 2008). This includes field testing soils and installing suitable temporary erosion and sedimentation controls. The proposed disturbance area will be limited to only the areas necessary to undertake the pipeline construction, site access and rehabilitation.

Mitigation by early rehabilitation following construction will be imperative to management. Rehabilitation activities will include replacing topsoil over the disturbed trench area and sowing of vegetation suitable for the current or proposed land use. This early sowing will provide competition for opportunistic weeds and also provide ground cover which should reduce the risks of surface erosion.





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- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Potential for naturally occurring asbestos

- High
- Medium
- Low

Source: EMM (2019); Regis Resources (2019); DFSI (2017); DRE (2015); GA (2011)

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Naturally occurring asbestos

McPhillamys Gold Project
Environmental impact statement
Figure 23.2

23.4.2 Soil resources

All soil excavated from the pipeline trench will be replaced and used to backfill the trench following the laying of the pipe. Topsoils (generally 0-200 mm below ground level (bgl) or to a point of obvious change), will be stripped and stockpiled separately from subsoils (generally >200 mm bgl). At the point of backfilling, subsoils will be reinstated and compacted first to a level that allows all the topsoil to be reinstated.

Therefore, this component of the project is considered a closed system for soil resources, in that the material excavated will be replaced in the trench. The impacts on soil resources will be limited to areas where land clearing is required for the construction and operation of the pumping station facilities. Soil from these areas will be placed in long term soil stockpiles adjacent to the site, seeded with pasture and managed to ensure this resource is available upon decommissioning in the future.

There is a risk of soil degradation whilst the soil is stockpiled during construction; however, the period during which stockpiling is anticipated is very short. Soil will be replaced in layers of subsoil first and topsoil on top where possible to ensure the valuable surface material remains at the surface.

23.4.3 Land and soil capability

There will be no permanent change to the LSC class throughout the pipeline footprint, apart from the pumping station facilities and access tracks. Therefore, it is anticipated there will be no permanent impact to agriculture resources within the pipeline footprint. The pumping station facilities will occupy a total maximum area of about 1.85 ha. The change in LSC Class along the 90 km pipeline corridor will therefore be negligible.

23.4.4 Disturbance of contaminated soils and contamination from spills

Part of the pipeline corridor and pumping stations 1, 2 and 3 are on sites which have been notified to the EPA as contaminated sites, although the EPA has determined (EPA 2019) that management under the CLM Act is not required. If inadequately managed, there is the potential for the spread of contaminated soils at these sites and potential to impact on water quality and human health. A geotechnical and soil survey will be undertaken as part of the detailed design process to inform the design and minimise the risk of contamination spreading. The pumping station facilities will be located in areas that avoid areas identified as potentially contaminated where possible.

The existing environment through which the pipeline traverses comprises mainly of agricultural and forestry activities, which have low contamination risk to human health and the environment.

Small areas of soil and surface water contamination could occur from hydrocarbon spills during the construction activities and during operation at the pumping station facilities. Potential contamination of land may also result from drilling fluid used for the under boring horizontal drilling of the earth during the construction of the pipeline. Drilling fluid has many functions which include suspending drill cuttings and prevent formation fluids. Drilling fluid will be contained and monitored if they are oil based or synthetic based fluids.

23.4.5 Salinity

Construction activities may impact on saline soils in the drainage depressions and drainage lines traversed by the pipeline corridor, with the potential to impact on water quality. The OEH has written guidelines for managing salinity in rural areas which sets out a range of management techniques to assist in managing existing dry land salinity and preventing the spread of salinity. One of the criteria for the route selection of the pipeline corridor was to avoid vegetation destruction as far as possible. Detailed design will seek to minimise vegetation removal within the pipeline corridor and this should reduce the potential for impacts from salinity.

23.4.6 Naturally occurring asbestos

The risks associated with the disturbance of naturally occurring asbestos is very low across the majority of the pipeline corridor; however if it is disturbed without adequate management and protections, there would be a risk to human health. The area within the pipeline corridor identified as having low potential for the presence of naturally occurring asbestos is adjacent to mine project area in the Vittoria State Forest (refer to Figure 23.2). The extensive exploration drilling program conducted to date in the mine project area has not identified any naturally occurring asbestos in cores drilled. Notwithstanding, Regis will follow appropriate procedures for naturally occurring asbestos as recommended by SafeWork NSW and in accordance with Regis' naturally occurring asbestos procedure.

23.4.7 Landforms

The potential impact on landforms as a result of the pipeline development is very minimal. The pipeline will be installed in an underground trench, with the excavated soil being used to cover the pipeline and rehabilitate it essentially to the existing profile. The pumping station facilities will be evident as structures on the land but will not affect the landforms or the geotechnical stability of the pipeline corridor.

23.5 Management and mitigation measures

The area of disturbance at any one time will be limited, as rehabilitation will be conducted on an ongoing basis during construction of the pipeline. This will allow for the appropriate field assessments (described in the sub-sections below) prior to construction to be conducted and the erosion and sedimentation controls to be established prior to any surface disturbance. A CEMP will be prepared and implemented prior to any construction activities. An OEMP will be prepared for the pipeline's operational phase. These plans will address the procedures and management of all aspects of land disturbance, soils, erosion and sediment controls and rehabilitation. A summary of the mitigation measures for each stage of construction is outlined below.

23.5.1 Soil testing

Soil testing for the following matters will be undertaken during the detailed design stage:

- salinity, particularly in the identified high hazard areas referenced in section 23.2.4;
- acid sulfate soils, particularly in the areas of low probability of occurrence and in the areas which have been submerged such as around the Macquarie River, Saltwater Creek, Evans Plains Creek and Queen Charlottes Creek; and
- naturally occurring asbestos in the area identified in the Vittoria State Forest.

In addition, a risk assessment will be carried out in relation to potential asbestos containing sites to identify the risk of airborne asbestos released into the air.

23.5.2 CEMP

i Erosion and sedimentation

Soil erosion and sediment management measures will be implemented during construction activities generally in accordance with the Blue Book. These controls are likely to include the use of sediment traps, silt barriers, and bunding or covering of soil stockpiles. Excavated land will be backfilled and compacted to reduce runoff. The reduction of runoff during the project cycle will help contain potential contaminants in designated areas.

Any disturbed ground will be stabilised and revegetated once relevant pipeline structures and associated infrastructure have been constructed.

ii Soil contamination

An unexpected finds protocol in relation to contamination will be developed. Any excess soil emanating from Centennial's Angus Place, SCSO or EA's MPPS to be disposed of off-site will be characterised and disposed of in accordance with the waste classification guidelines (EPA 2014).

Fuels, oils and chemicals stored on the construction site will be kept to a minimum and will be stored in appropriate storage containers as specified in the relevant Australian Standards. Spill kits will be available during refuelling. Oil and fuel leakages from vehicles and equipment will be minimised through regular maintenance.

iii Naturally occurring asbestos

Any naturally occurring asbestos identified in the pipeline corridor will be managed and remediated in accordance with Regis' naturally occurring asbestos procedure to ensure that workers and the community are protected during construction. The removal of in-situ asbestos at work will comply with the *Work Health and Safety Regulation 2017*.

iv Soil stripping

Soils along the pipeline will be stripped and topsoil (0-200 mm) stockpiled separately from subsoil (generally >200 mm). The periods during which the excavated soil is stockpiled will be limited to avoid excessive erosion and sedimentation. Stockpiles will be located at an appropriate distance from watercourses and dams to avoid contamination. At the point of backfilling, subsoils will be reinstated and compacted first to a level that allows all the topsoil to be reinstated with a light compaction.

v Rehabilitation

Rehabilitation of the pipeline corridor following the pipe laying will be done on an ongoing basis throughout the construction period. The topsoil will be stripped to be replaced generally over the land from which it has been removed, with handling of the topsoil to be minimised. Some planting of pasture or native vegetation will be required and will be done in consultation with the property owner. Rehabilitation of the pipeline corridor is discussed further in Chapter 35.

23.5.3 Operational environmental management

Where practicable, maintenance activities involving the handling of fuels, oils or lubricants will be undertaken in bunded areas. It is not proposed to store chemicals or fuels in the pumping station facilities during the operational phase of the pipeline development; however, if any are stored, they will be retained in bunded containers and in appropriate storage containers as specified in the relevant Australian Standards.

The OEMP will contain specific mitigation measures such as:

- protocols for hydrocarbon storage and actions to be taken if spills or leaks are identified; and
- ongoing review and management of erosion within the pipeline corridor.

Regular monitoring inspections of the pipeline corridor for potential soil issues will be undertaken on a regular basis and will form the basis of environmental maintenance priorities. Monitoring procedures will be documented in the OEMP.

23.6 Conclusion

The proposed 90 km pipeline development will temporarily impact on the soils and land resources of the proposed 127 ha corridor through the excavation of soils for the laying of pipe in a trench. The management of all aspects of the above assessment will be detailed in the CEMP to ensure the temporary nature of impacts. The implementation of the CEMP will provide for effective land management and minimising impacts within the pipeline corridor.

Chapter 24

Water resources

REGIS RESOURCES LTD

24 Water resources

24.1 Introduction

This chapter provides a summary of the results of the water assessment undertaken for the pipeline development (EMM 2019f). The full technical assessment is contained in Appendix X.

The EARs require the water conditions during construction and operation of the pipeline to be assessed in accordance to the following requirements in Table 24.1.

Table 24.1 Water related EARs - pipeline development

Requirement	Section addressed
Water – including an assessment of the likely impacts of the development on the quantity and quality of surface, and groundwater, having regard to the *NSW Aquifer Interference Policy*;	Appendix X Section 2.3, 2.4.2, 5 & 6 This chapter – Section 24.4
an assessment of the hydrological characteristics of the site and downstream;	Appendix X Section 3.2 and 5 Appendix B of Appendix X This chapter – Section 24.3
an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure and systems and other water users, including impacts to water supply from Carcoar Dam, riparian and licensed water users, use and discharge of water during construction, commissioning and maintenance of the pipeline infrastructure;	Appendix X Chapters 5 and 6 This chapter – Section 24.4
demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP);	Appendix X Section 2 Section 2.3
a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; and	Appendix X Section 2 Section 2.2.3
a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts;	No water management system required for pipeline. Mitigation in Appendix X Section 5.4 and 6.2. This chapter
a description of construction erosion and sediment controls, how the impacts of the development on areas of erosion, salinity or acid-sulphate risk, steep gradient land or erodible soils types would be managed and any contingency requirements to address residual impacts; and	Appendix X Sections 23.4.2 and 24.4.
an assessment of the potential flooding impacts of the project;	Appendix X This chapter – Section 24.4.2

24.2 Assessment approach

The water assessment included the following:

- geomorphology assessment;
- surface water assessment;
- groundwater assessment; and

- flooding assessment.

An initial desktop assessment was used to collate water quality, flow, groundwater and flooding data. Mapping of the region using digitised 1:25,000 topographic maps prioritised streams for field inspection. EMM carried out three of the above assessments (surface water, groundwater and flooding) using the information obtained in the desktop research. Dr Christopher Gippel, of Fluvial Systems Pty Ltd, was engaged to assist in the preparation of the geomorphology assessment for creeks crossed by the proposed pipeline route. The full geomorphology report is included in Appendix B of the Water Assessment Report (refer to Appendix X of this EIS).

The pipeline corridor intersects 131 hydrolines (based on the 'blue line' drainage network dataset, which is a collaborative effort by Geoscience Australia and state governments). Given the inadequacies of the hydroline ('blue line') network, a revised drainage network was automatically generated using GIS by Fluvial Systems as part of the geomorphology assessment, in the catchments of watercourses intersecting the pipeline route. Reassessment of the watercourse/pipeline intersections using automatically DEM-generated drainage lines showed that the pipeline will cross 112 drainage lines. These drainage lines were then filtered based on size and classified into minor or major watercourses. Pipeline crossings of larger watercourses were considered higher priority and required detailed field inspections. Twenty crossing locations were inspected in the field, during which photographs were taken and data collected including downstream and upstream directions, structure and cover of riparian vegetation, bed sediment material calibre and depth of sand in the bed of sand-bed streams.

The geomorphology assessment focused on geomorphic characteristics of the watercourses in the vicinity of the pipeline intersections that were relevant to the main risks associated with the pipeline during its operational phase, which are:

- geomorphic change may lead to exposure of the pipeline to fluvial forces, thereby putting the integrity of the pipeline at risk; and
- the presence of the pipeline (usually in combination with being exposed through geomorphic change) will interfere with natural geomorphic processes.

24.3 Existing environment

24.3.1 Surface Water

The pipeline corridor traverses seven water catchments, with eight permanent water courses crossed by the pipeline in six of the eight catchments. Numerous minor streams and gullies along the pipeline route are non-perennial and only have flow after large rainfall events. The drainage lines traversed by the pipeline corridor can be seen in Figures 2.2a to 2.2h. The more detailed plans of the pipeline corridor in Appendix V show the hydrology of the pipeline corridor in further detail.

Each of the permanent streams (from east to west) is associated with the following surface water sources:

- Coxs River – Upper Nepean and Upstream Warragamba Water Source (Wywandy Management Zone);
- Pipers Flat Creek – Upper Nepean and Upstream Warragamba Water Source (Wywandy Management Zone);
- Wangcol Creek – Upper Nepean and Upstream Warragamba Water Source (Wywandy Management Zone);
- Salt Water Creek – Fish River Water Source;
- Macquarie River – Macquarie River upstream of Burrendong Dam Water Source (including the Macquarie River above Bathurst and Macquarie River Tributaries Management Zones);

- Queen Charlottes Creek – Queen Charlottes Vale Evans Plains Creek Water Source (including the Queen Charlottes Vale Evans Plains Creek Downstream and Queen Charlottes Vale Evans Plains Creek Tributaries Management Zones);
- Evans Plains Creek – Queen Charlottes Vale Evans Plains Creek Water Source (including the Queen Charlottes Vale Evans Plains Creek Downstream and Queen Charlottes Vale Evans Plains Creek Tributaries Management Zones); and
- McLeans Creek – Queen Charlottes Vale Evans Plains Creek Water Source (including the Queen Charlottes Vale Evans Plains Creek Downstream and Queen Charlottes Vale Evans Plains Creek Tributaries Management Zones).

A desktop analysis of water quality (Appendix X) identified that the salinity of the streams is likely to range from fresh to slightly saline (ie less than 500 mg/L) to around 1500 mg/L TDS.

24.3.2 Groundwater

The pipeline corridor crosses areas within three groundwater sources. Groundwater quality varies across the water sources and is impacted by the geology and historical land use. In the areas adjacent to the proposed pipeline, the groundwater quality is expected to vary from fresh to slightly saline. Typically, the salinity range would be 500–2500 mg/L total dissolved solids (TDS). The proposed pipeline alignment is predominantly contained within the Lachlan Fold Belt MDB Groundwater Source. The aquifers within this groundwater source are restricted to areas of secondary porosity (fracture flow/faulting) where reasonable groundwater yields can be achieved. Water table depths are generally deeper than 10 mbgl. Notably, the pipeline trench will be around 1.3 to 2 m deep.

Key characteristics of the groundwater source is described in Table 24.2. Groundwater use along the proposed pipeline route is typically for stock and domestic purposes, as well as industrial (WaterNSW 2019b).

Table 24.2 Groundwater source characteristics – pipeline development

Groundwater Source	Type	Aquifer Depth (minimum)	Depth to Private Bores (minimum)
Sydney Basin Coxs River Groundwater Source	Porous groundwater source	25 to 50 metres below ground level	Greater than 5 metres below ground level
Sydney Basin Murray Darling Basin (MDB) Groundwater Source	Porous groundwater source	30 to 75 metres below ground level	Generally greater than 10 metres below ground level, although at creek and river crossings, it can be 1.5–3 m bgl
Lachlan Fold Belt Murray Darling Basin (MDB) Groundwater Source	Large fractured rock groundwater source	30 to 75 metres below ground level	Generally greater than 10 metres below ground level, although at creek and river crossings, it can be 1.5–3 m bgl

24.3.3 Geomorphology

Twenty watercourse crossings were assessed as part of the field assessment undertaken to assess geomorphic attributes and stability. The locations, Strahler stream order and perennialism are summarised in Appendix X. With the exception of the Macquarie River, all watercourse crossings investigated by the assessment were classified as 'minor'.

24.3.4 Flooding

Flooding risks for areas traversed by the pipeline has been assessed against the published studies from the Australian Flood Risk Information Portal hosted by Geoscience Australia. Of the publicly available flood studies only the Bathurst Floodplain Management Plan (1993) contains a 1 in 100 year flood extent map for the Bathurst region (Appendix X). The 1 in 100-year flood extent intersects two sections of the corridor; near pumping station facility No.4 and near the intersection of Vale Road and the Great Western Railway line.

24.3.5 Raw water quality

The water quality of the proposed raw water sources currently ranges from around 600 mg/L total dissolved solids (TDS) to around 7,000 mg/L TDS with a likely average of around 3,500 mg/L TDS. For reference, it is noted that the NSW Department of Primary Industries fact sheet *Water Requirements for Sheep and Cattle* (2014) identifies salinity suitable for stock drinking water (TDS mg/L) in the following ranges:

- Sheep: 5,000 – 10,000, and up to 13,000 for limited periods; and
- Beef Cattle: 4,000 – 5,000, and up to 10,000 for limited periods.

24.4 Impact Assessment

24.4.1 Construction

i Surface water flows

The construction of the pipeline is expected to have negligible impacts on water flows due to the immediate backfill and rehabilitation of disturbed areas once the pipeline is laid. However, any substances entering watercourses as a result of construction has the potential to impact upon water quality.

Appropriate construction and erosion and sediment control measures can be deployed to reduce the overall environmental risks associated with the pipeline construction. Erosion and sediment controls will be implemented in accordance with the 'Blue Book' (*Managing urban stormwater: soils and construction* (Landcom 2004)) and leading practice, and the measures will be outlined in an Erosion and Sediment Control Plan to be incorporated into the pipeline CEMP.

The risk of flooding affecting work sites during construction is limited to locations adjacent to or within creeks, and on riverine floodplains. No laydown or storage areas will be located in gullies or floodways to avoid disturbing stormwater runoff after rain. Further, the scheduling of works in floodplains will be undertaken in consideration of weather predictions so that periods of heavy rain are avoided. Detailed measures to effectively manage the risk of flooding will be detailed in the CEMP.

ii Geomorphology/watercourse impacts

The geomorphological investigations found that the stability of the beds and banks of the watercourses within the study area are characteristic of streams in disturbed settings and that there is little evidence of recent bank or bed erosion. This suggests that the streams, despite historic degradation from their natural state, are relatively stable. Most sites have moderate combined vegetation cover.

With careful analysis of site-specific geomorphic constraints during detailed design, and the adoption of appropriate construction measures and environmental controls, risks associated with pipeline crossings of the waterways along the corridor can be minimised.

The geomorphic assessment (Appendix X) concluded that the construction and operation of the pipeline presented a negligible to low risk to the geomorphology of the watercourses traversed by the pipeline corridor.

iii Groundwater

Construction activities are not expected to interfere with groundwater resources or quality as trenching will typically be relatively shallow (1.3 m to 2 m) compared to the likely depth of the water table (generally >10 mbgl). It is unlikely then that the work will intercept groundwater aquifers or their flow systems.

The exception to this is the quaternary sandy alluvium associated with major river and creek crossings. The alluvium is unconsolidated and relatively thin (less than 15 m thick) but groundwater levels can be high with water tables generally 1.5–3 mbgl.

Consequently, underboring of the pipeline is proposed at the Macquarie River and Queens Charlottes Creek (Vale Creek) to protect stream flows and to minimise disturbance to shallow groundwater. Underboring will allow the pipeline to be specifically positioned at the base of the alluvium or into the weathered rock profile so as to not affect groundwater flows or water quality. The detailed design phase will confirm whether additional watercourses, particularly Evans Creek and Saltwater Creek, warrant underboring.

Isolated perched groundwater intercepted during trenching will appear as slow seepage into the base of the open trench. Provided the laying of the pipeline and backfilling of the trench is done to avoid trench collapse or impact to the groundwater system, it is expected that negligible groundwater flows will occur towards trenching works.

Construction activities can cause contamination of soils and therefore groundwater as a result of oil and/or fuel leaks from operating construction equipment. However, the risk can be mitigated through implementation of standard construction management measures, and the depth to known groundwater (>10 mbgl). The likelihood and potential significance of these impacts is considered to be low.

24.4.2 Operation

i Pipeline water management

Operation (opening) of the scour valves will allow dewatering of the pipeline for repairs and maintenance. Dewatering will involve release of water from the pipeline to scour pits via the scour valves. Scour water will be transferred from the pits via a suction tanker truck to the mine site, to an appropriately licensed wastewater treatment facility such as Bathurst Council’s sewage treatment plant, or pumped to the nearest pumping station or the next appropriate pipeline section. There will be no discharge of water to the environment under normal operating conditions.

Every few years the pipeline may require cleaning to prevent the build-up of material on the inside of the pipeline. If required, water from this cleaning process will contain chlorine and material scoured from the wall of the pipe. Water will be transferred from the scour pits via a suction tanker truck to the mine site or to an appropriately licensed wastewater treatment facility.

A pipeline instrumentation system (flowmeters and pressure transducers) fault detection system will be incorporated within the pipeline design. If a pipeline leak occurs, the fault detection systems will shut down the water transfer and isolate the leak via isolation or section valves. In the event of a suspected pipe leak spill, the maximum discharge to the environment likely to be in the order of 0.4-0.9 ML.

With leak detection measures, periodic inspections, maintenance and monitoring, the likelihood of a pipeline leak causing water quality impacts on the environment is considered rare and the risk is assessed as low.

ii Flooding

A number of pipeline elements including scour, air and isolation valves, pumping station facilities and the pressure reducing system will be located above ground. With the exception of some scour and isolation valves, all elements will be located outside of the 1 in 100-year flood extent. In the event of flooding, the pipeline can continue operation. The risk of the pipeline development being affected by or affecting flooding is low.

24.5 Management and mitigation

24.5.1 Construction

The CEMP will include the following management measures to mitigate potential impacts on water resources along the pipeline corridor.

Mobilisation of soil during construction will be managed through industry standard erosion and sediment control practices, and minimising the time that trenches are open. These controls could take the form of sediment traps, silt barriers, and bunding or covering of soil stockpiles. These controls and landscape rehabilitation measures on completion of trenching will reduce the likelihood and magnitude of erosion, scour and redeposition. Oil and fuel spillage, and migration of construction materials such as bedding material and concrete are also potential events that could impact water quality.

During construction, the following measures will be implemented to monitor and manage potential impacts to surface water:

- periodic monitoring of water quality will be carried out where the pipeline corridor crosses permanent stream locations;
- refuelling of plant and equipment will be constrained to designated/bunded areas or will be off site;
- chemicals and construction materials will be stored appropriately in designated/bunded areas;
- a waste management plan will be included in the CEMP for the control and storage of waste at work sites;
- operations at work sites will be reviewed and audited to ensure management measures are being implemented accordingly;
- geomorphic monitoring will be carried out after significant storm runoff events. An inspection will be conducted following a 1 in 5-year ARI regional storm event;
- work areas and equipment compounds will be located away from flood prone areas. This risk will be managed by monitoring weather conditions, weather forecasts, and river levels. When flood risk is notified, active work sites will be secured, and personnel moved off site; and
- the pipeline development will be constructed to minimise the potential impacts on the watercourse geomorphology in accordance with *Guidelines for laying pipes and cables in watercourses on waterfront land* (NSW Office of Water 2012).

24.5.2 Operation

Appropriate pipeline dewatering and maintenance procedures will be incorporated into the overarching OEMP for the project.

During operation, isolation or section valves will isolate the pipeline into discrete sections and allow individual sections to be dewatered for maintenance, or to provide security in an event such as a pipeline leak. Isolation valves will also be installed on either side of major watercourse crossings.

During pipeline maintenance, process water removed from the pipeline via valves will not be discharged to rivers or creeks. It is anticipated that process water held in the pipeline sections that require maintenance will be removed via tanker trucks and taken to either the mine project area, an appropriately licensed wastewater treatment facility, or pumped to the nearest pumping station or the next appropriate pipeline section. Annual visual inspections of key watercourse crossings will be conducted to detect any significant geomorphic changes during the operation of the pipeline. Bank and bed stabilisation works will be undertaken if required.

24.6 Conclusion

The potential for impacts to major watercourses traversed by the pipeline corridor has been avoided through design of the pipeline construction methodology; Macquarie River and Queens Charlottes Creek (Vale Creek) will be underbored to protect stream flows and to minimise disturbance to shallow groundwater.

Industry standard erosion and sediment control practices (such as in accordance with the Blue Book) will be implemented along the pipeline corridor throughout the construction phase of the pipeline. With the successful implementation of these measures, the potential risk to surface water and groundwater resources as well as watercourse geomorphology is considered low from construction of the pipeline development. These management, mitigation and monitoring measures will be documented in detail in the CEMP for the pipeline.

25 Noise and vibration

25.1 Introduction

This chapter provides a summary of the Noise and Vibration Assessment (NVA) prepared for the pipeline development (MAC 2019b). A full copy of the NVA is provided in Appendix AA.

The EARs require the potential impacts resulting from noise, vibration and blasting to be assessed in accordance with the following guidelines:

- *Noise Policy for Industry* (EPA, 2017) (NPI);
- *Voluntary Land Acquisition and Mitigation Policy* (DPE 2018a);
- *Interim Construction Noise Guideline* (DECC 2009) (ICNG);
- *NSW Road Noise Policy* (EPA);
- *Assessing Vibration: a Technical Guideline* (DEC 2006); and
- relevant ANZECC guidelines.

The EARs relating to the noise and vibration assessment of the pipeline development are summarised in Table 25.1.

Table 25.1 Noise, vibration and blasting related EARs – pipeline development

Requirement	Where addressed
Noise, Vibration and Blasting – including an assessment of the likely operational noise impacts of the development (including construction noise) in accordance with the *Noise Policy for Industry NSW*, and the *Voluntary Land Acquisition and Mitigation Policy*;	This chapter, and NVA: 7.1, 7.2, 7.3, 7.4 (Appendix AA)
if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities in accordance with the *Interim Construction Noise Guideline*;	NVA: 7.1, 7.2, 7.3, 7.4 (Appendix AA) Section: 25.5
an assessment of the likely road noise impacts of the development in accordance with the *NSW Road Noise Policy*; and	NVA: 7.6 (Appendix AA) Section 25.6.2
an assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guidelines;	NVA: 7.7, 7.8 (Appendix AA)

25.2 Methodology

The *Interim Construction Noise Guideline* (ICNG) outlines a simplified qualitative assessment methodology for assessing construction related noise; however, the NVA for the pipeline adopted a more complex quantitative assessment methodology to suit major construction projects with typical durations of more than three weeks. The quantitative assessment involved predicting noise levels and comparing them with the noise management levels specified in the ICNG. The assessment involved the following tasks:

- identifying noise sensitive receivers;
- background noise monitoring;
- establishing operational and construction noise criteria based on relevant guidelines and the results of noise monitoring;
- establishing construction vibration and blasting criteria;
- assessing potential construction, operation and traffic noise impacts, by:
    - noise modelling to predict the potential for impacts at sensitive receivers;
    - assessing predicted impacts against noise criteria;
- assessing potential construction vibration impacts;
- assessing potential blasting overpressure and ground vibration impacts; and
- providing recommended mitigation and management measures to reduce potential impacts.

25.3 Existing environment

The majority of the pipeline corridor traverses rural and rural residential land, as described in Chapter 5, with the potential for low levels of background noise. It also travels through a number of State Forests, and some areas of native woodland vegetation. At the eastern extent of the pipeline development the corridor passes through highly disturbed land used for mining and power generation at Angus Place, SCSO and MPPS.

25.3.1 Noise sensitive receivers

Potential noise sensitive receivers are those that may be impacted by noise and vibration impacts, and for the pipeline development are considered to be the receivers within 1 km of the pipeline corridor. Approximately 297 potential noise sensitive receivers have been identified along the pipeline corridor, sorted into nine catchments. The majority of these receivers are residential properties. Other receivers include:

- active recreation – Portland Golf Club (R54), Bathurst Cycling Club (R271), and Bathurst Mountain Bike Club (R272);
- passive recreation - Newnes State Forest (R1), Sir Joseph Banks Nature Park (R277), Vittoria State Forest (R296) and Portland Town Common (R293);
- place of worship - Church at Gormans Hill (R294);
- commercial - Reid and Sulman Campground (R278) and Kirkconnell Correctional Centre (R149); and
- industrial - Bathurst Community Recycling Centre (R274), Omya Australia Pty Ltd (R270) and The Junktion reuse and recovery centre near Bathurst (R273).

In addition, while the pipeline corridor does not extend over any historic heritage listed item, it will traverse land adjacent to two heritage items:

- Leeholme Homestead and outbuildings at 3664 O’Connell Road and 47 Tarana Road; and

- Portland General Cemetery at Sunny Corner Road.

The identified noise sensitive receivers in each catchment are shown in Figure 25.1 and listed in Table 25.2.

Table 25.2 Noise sensitive receivers along the pipeline corridor and their catchments

Catchment	Receiver ID
Angus Place	R1 – R40
Portland	R41 – R99; R100 – R135; R293
Sunny Corner	R136 – R148
Yetholme	R149 – R187; R192 – R194; Kirkconnell Correction Centre
Brewongle	R188 – R191; R195 – R204
Bike Park	R205 – R256, R259, R260
Perthville	R257, R258, R261 – R285; R294; R297, AR33[1]
Bathampton	Nil
McPhillamys	R286-R292: R295, R296

Note 1: Representative of Bathurst Cycling Club, Bathurst BMX track and Bathurst Mountain Bike Park.

25.3.2 Noise monitoring locations

Background noise levels were measured at representative receiver locations to quantify existing noise levels and establish a Rating Background Level (RBL).

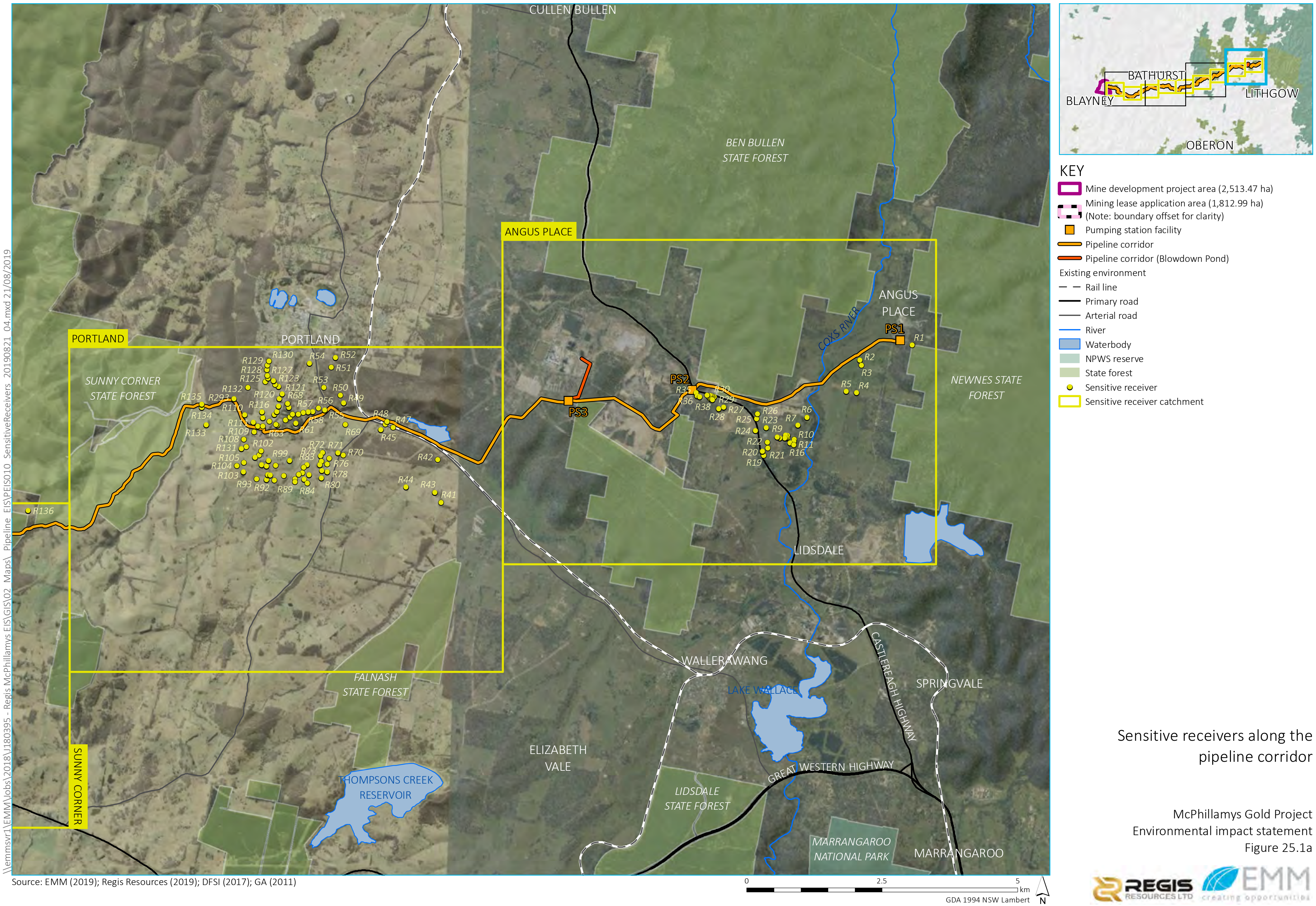
Background noise monitoring locations were established at three representative receiver locations at Walang, Portland and Blackmans Flat. Default 'rural' background noise levels were applied at the remaining receivers as specified in the *Noise Policy for Industry 2017* (NPI) (EPA 2017).The noise monitoring locations are identified in Figure 25.2.

25.3.3 Noise monitoring levels

Unattended noise monitoring results are summarised in Table 25.3. The monitoring locations are sorted into catchments to represent differences in activity between different catchment areas. The Angus Place catchment will have higher acceptable RBL thresholds due to its mining operations than the agricultural setting at Sunny Corner Road in Portland, which will have lower acceptable RBL thresholds. The monitoring locations, ie NM5 (Angus Place), NM8 (Portland) and NM0 (Yetholme), were chosen as they are considered representative of the background and ambient noise environments for all residential receivers potentially impacted by the pipeline development.

The NPI specifies that where measured background noise levels are less than 30 dB(A) for evening and night periods, the applicable background noise level is set to 30 dB(A) and where they are less than 35 dB(A) for the daytime period, background noise levels are set to 35 dB(A). These levels form the threshold levels used to model potential project impacts on sensitive receivers.

Night-time RBLs were below 30 dB(A) at NM5 Angus Place, NM8 Portland and NM0 Yetholme catchments. Day time RBLs were only below 35 dB(A) at NM8 Portland (30 dB(A)). Daytime RBLs exceeded the background noise level threshold at NM5 Angus Place and NM0 Yetholme.



Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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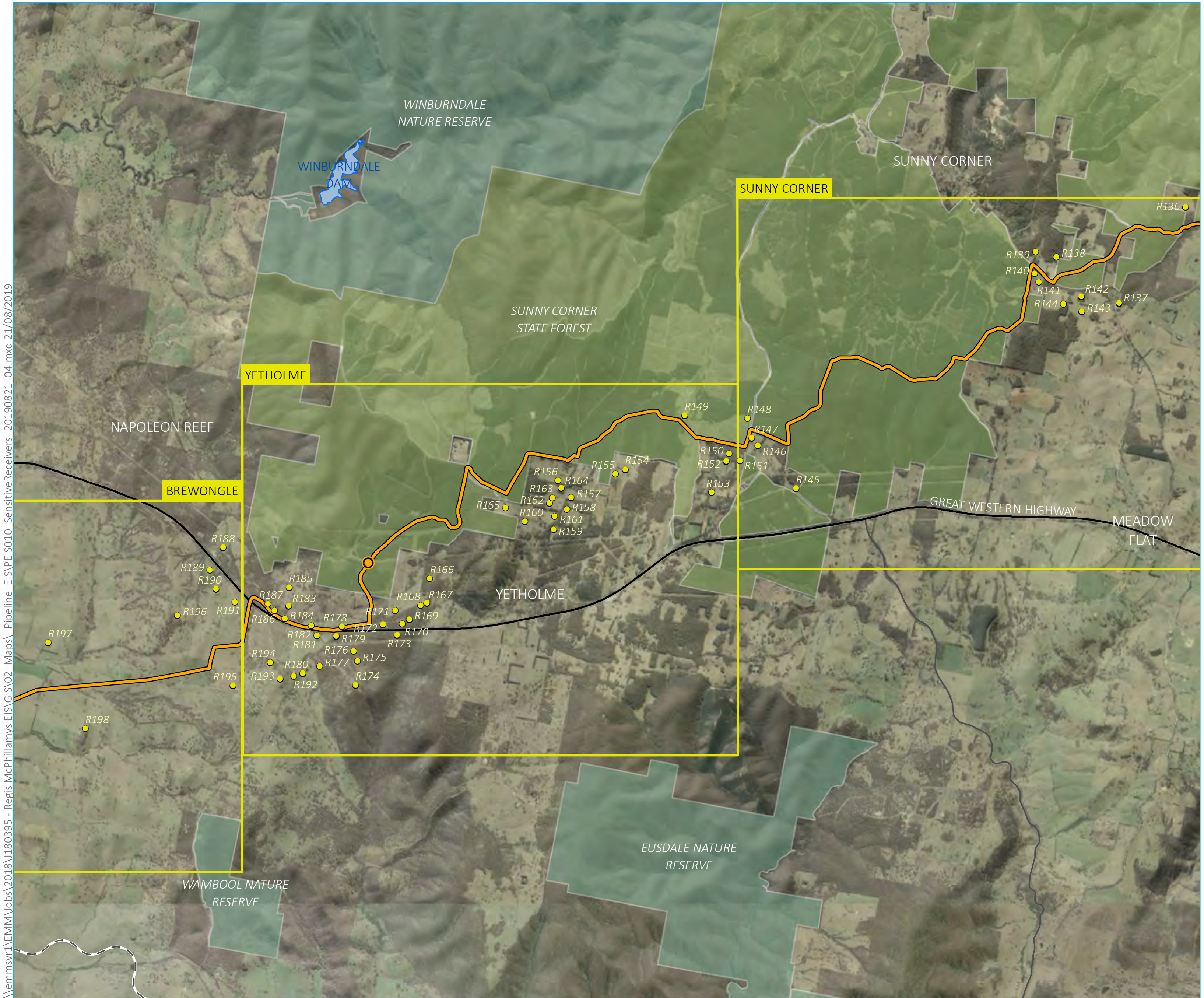
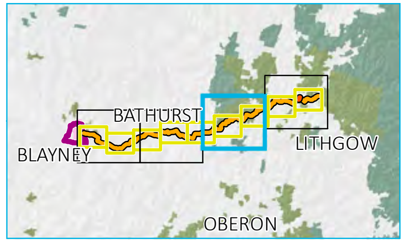
Sensitive receivers along the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 25.1a





KEY
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment
- Rail line
- Primary road
- Arterial road
- Waterbody
- NPWS reserve
- State forest
- Sensitive receiver
- Sensitive receiver catchment

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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Sensitive receivers along the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 25.1b

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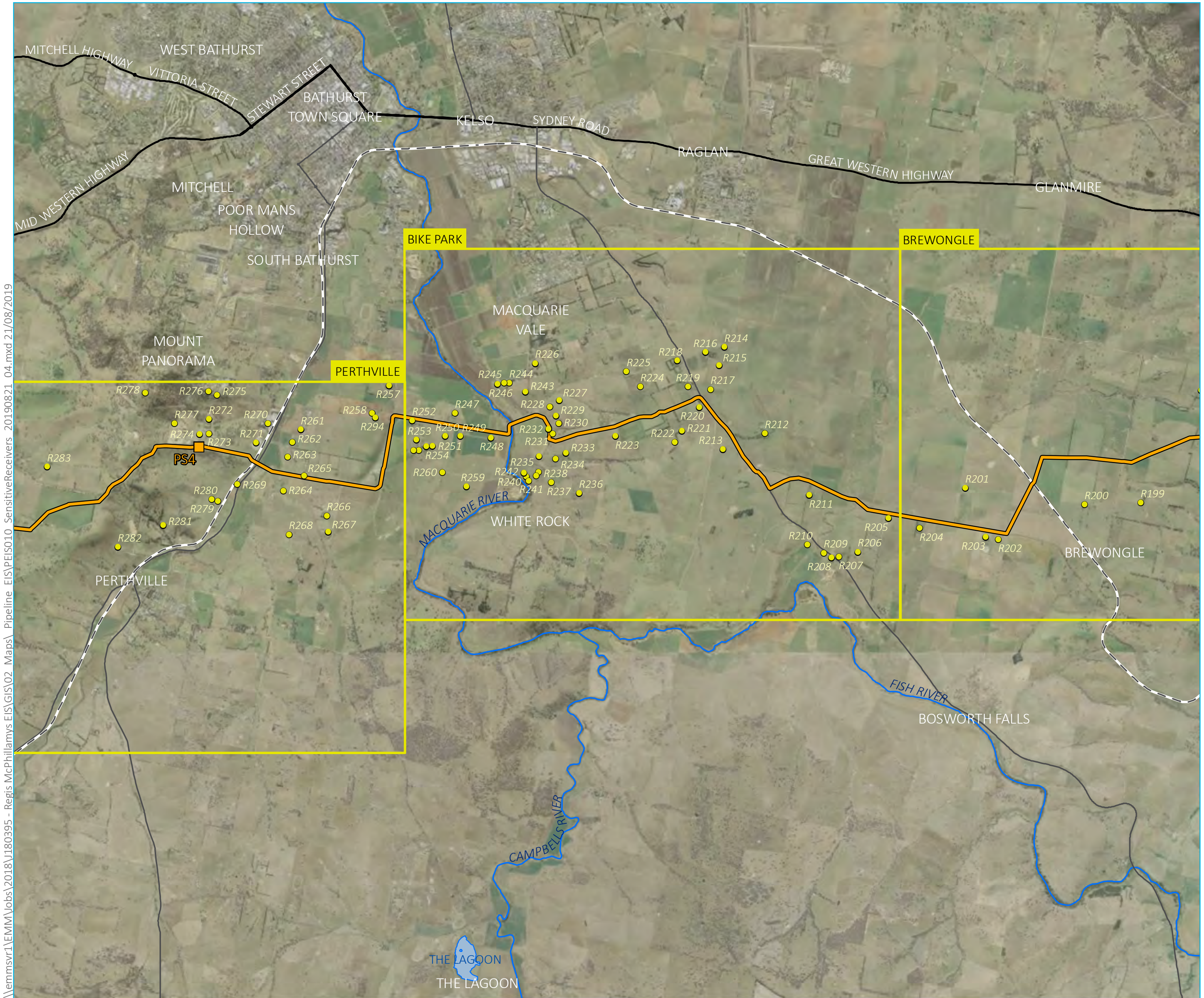

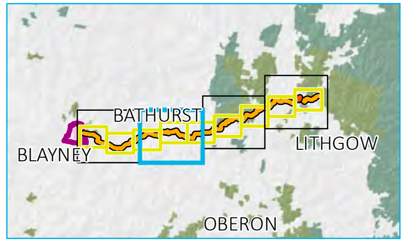

KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest
- Sensitive receiver
- Sensitive receiver catchment

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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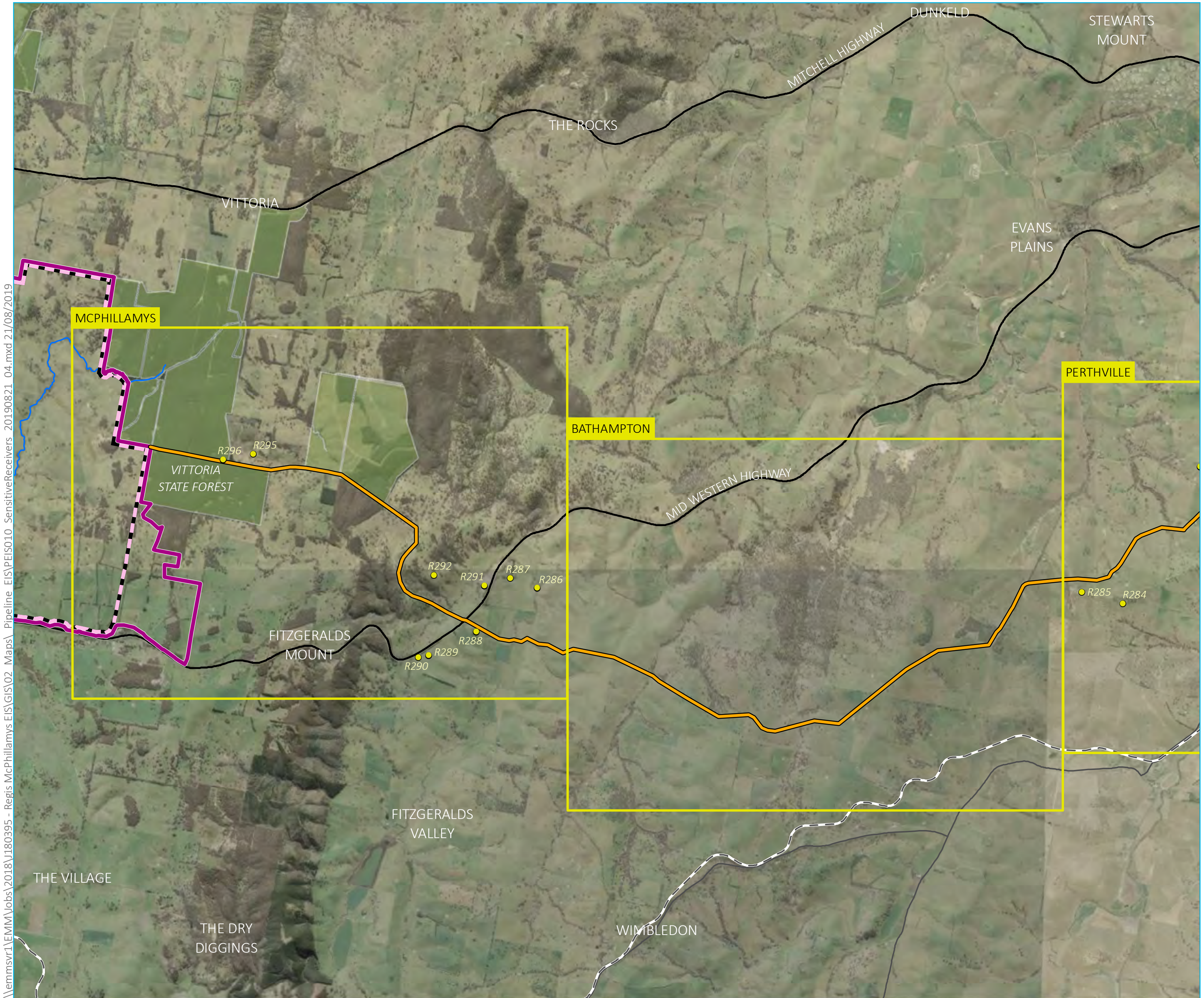
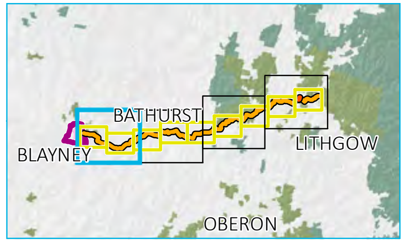
Sensitive receivers along the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 25.1c





KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- NPWS reserve
- State forest
- Sensitive receiver
- Sensitive receiver catchment

Source: EMM (2019); Regis Resources (2019); DFSI (2017); GA (2011)

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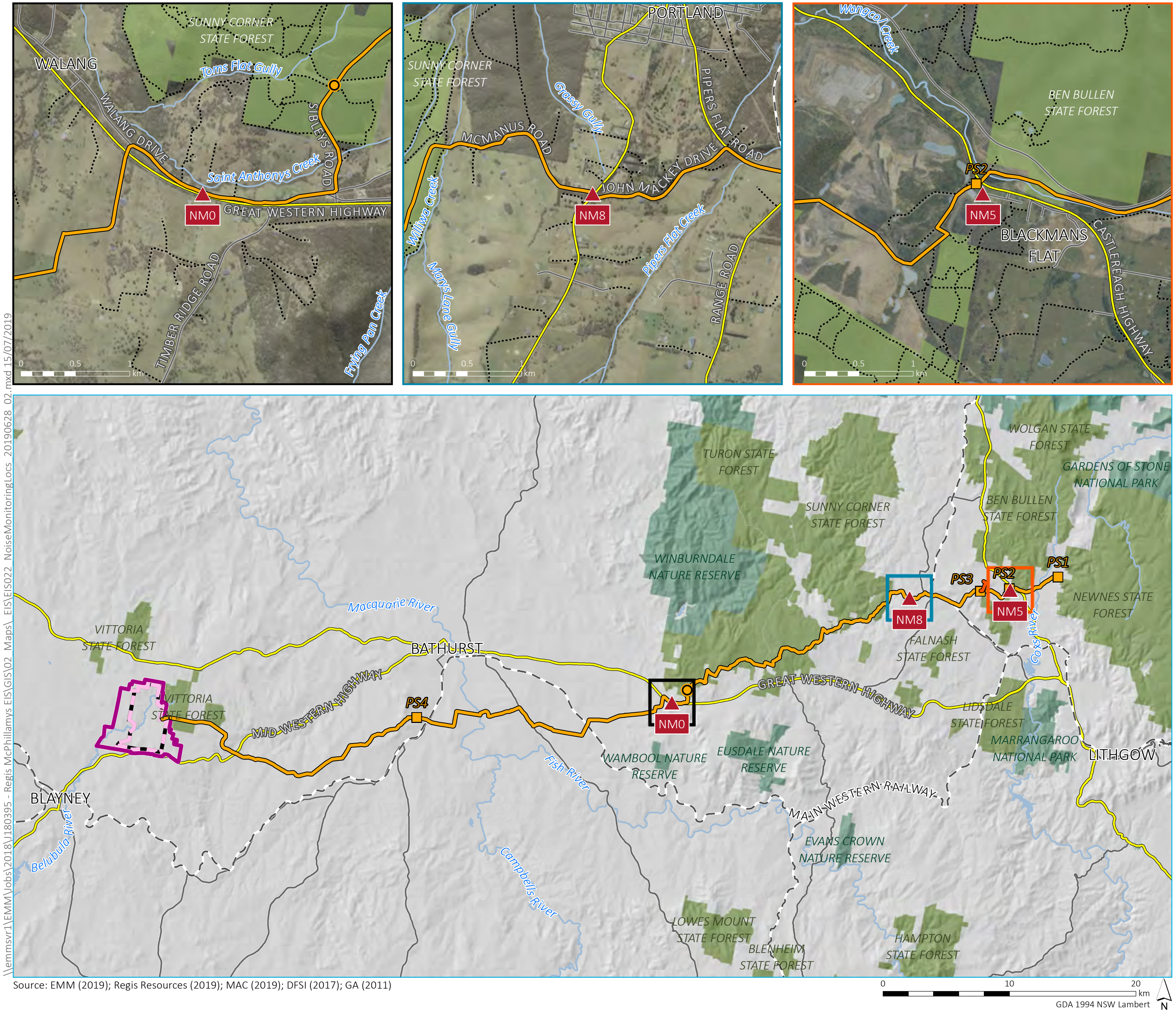
Sensitive receivers along the pipeline corridor

McPhillamys Gold Project
Environmental impact statement
Figure 25.1d



KEY

- Unattended noise monitoring location
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road (overview) / Main road (insets)
- Arterial road (overview) / Local road (insets)
- Vehicular track (insets)
- River (overview) / Named watercourse (insets)
- Waterbody
- NPWS reserve
- State forest

Source: EMM (2019); Regis Resources (2019); MAC (2019); DFSI (2017); GA (2011)

Pipeline development noise monitoring locations

McPhillamys Gold Project
Environmental impact statement
Figure 25.2

\\emmsvr1\EMM\Jobs\2018\J180395 - Regis McPhillamys EIS\GIS\02_Maps\EIS022_NoiseMonitoringLocs_20190628_02.mxd 15/07/2019

Table 25.4 Construction periods modelled in the pipeline development noise assessment

Period	Hours
Standard Construction Hours	Monday to Friday – 7 am to 6 pm Saturdays – 8 am to 1 pm Sundays or Public Holidays - No construction
Out of Hours Period 1	Monday to Friday – 6 pm to 10 pm Saturdays – 7 am to 8 am and 1 pm to 10 pm Sundays or Public Holidays – 8 am to 6 pm
Out of Hours Period 2	Monday to Friday – 10 pm to 7 am Saturdays – 10 pm to 8 am Sundays or Public Holidays – 6 pm to 7 am

25.4.2 Construction criteria (noise management levels)

Construction noise is assessed to determine if the pipeline development complies with the noise management levels (NML), as defined by the ICNG, during standard construction hours and out of hours periods. The predicted noise levels are compared to the NMLs to identify sensitive areas for noise management and mitigation. The relevant NMLs for standard construction hours and out of hours periods are presented below.

i Residential receivers

The RBL is used when determining the noise management level. Table 25.5 lists the noise management levels for residences (in accordance with the ICNG) and how they are applied.

The noise affected management level represents the point above which there may be some community reaction to noise. According to the ICNG, for residences which are noise affected:

- where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level; and

- the proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

The highly noise affected level represents the point above which there may be strong community reaction to noise. According to the ICNG, where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur.

Table 25.5 ICNG construction noise management levels for residential receivers

Time of day	Noise Management level LAeq (15 min)	
Standard construction hours	Noise affected	RBL + 10 dB(A)
	Highly noise affected	75 dB(A)
Outside recommended construction hours	Noise affected	RBL + 5 dB(A)

Based on the noise management levels from the ICNG shown in Table 25.5 and the monitored background noise levels in Table 25.3, the applicable construction noise management levels for residential receivers in each catchment are shown in Table 25.6.

Table 25.6 Construction noise management levels for residential receivers

Catchment	Reference RBL	Assessment Period[1]	RBL, dBA[2]	Noise Management Level dB LAeq(15min))
NM5 (Angus Place)	NM5 (Angus Place) Noon Street	Day (Standard Hours)	37	47 (RBL+10dBA)
		Evening (OOH[3] Period 1)	34	39 (RBL+5dBA)
		Night (OOH Period 2)	30 (27)	35 (RBL+5dBA)
NM8 (Portland)	NM8 (Portland) Sunny Corner Road	Day (Standard Hours)	35 (30)	45 (RBL+10dBA)
		Evening (OOH Period 1)	30 (31)	35 (RBL+5dBA)
		Night (OOH Period 2)	30 (26)	35 (RBL+5dBA)
NM0 (Yetholme)	NM0 (Yetholme) Great Western Highway	Day (Standard Hours)	47	57 (RBL+10dBA)
		Evening (OOH Period 1)	37	42 (RBL+5dBA)
		Night (OOH Period 2)	30 (23)	35 (RBL+5dBA)
Sunny Corner Brewongle Bike Park Perthville Bathampton McPhillamys	Default NPI RBLs	Day (Standard Hours)	35	45 (RBL+10dBA)
		Evening (OOH Period 1)	30	35 (RBL+5dBA)
		Night (OOH Period 2)	30	35 (RBL+5dBA)
AR33	N/A	When in use	N/A	65 (external)
Kirkconnell Correction Centre[4]	N/A	Day (Standard Hours)	N/A	50
		Evening (OOH Period 1)	N/A	45
		Night (OOH Period 2)	N/A	40

Notes:

1: Recommended Hours for construction are shown in Table 25.4

2: NPI default RBL adopted for the assessment, measured level shown in brackets.

3: Out of Hours - OOH.

4: The applicable Amenity Noise Level (NPI Table 2.2) for the receiver area has been applied as it is a mixed-use receiver.

ii Other receivers

The ICNG sets out the NMLs for various other 'sensitive land uses' and industrial premises. The NMLs for other receivers are shown in Table 25.7.

Table 25.7 ICNG noise management levels for non-residential receivers – pipeline development

Land use	Sensitive Receivers	Noise Management Level dB LAeq(15min)
Active recreation	Portland Golf Club (R54), Bathurst Cycling Club (R271), and Bathurst Mountain Bike Club (R272)	External noise level 65 dB(A)
Passive recreation	Newnes State Forest (R1), Sir Joseph Banks Nature Park (R277), Vittoria State Forest (R296) and Portland Town Common (R293)	External noise level 60 dB(A)
Place of worship	Church at Gormans Hill (R294)	Internal noise level 45 dB(A)
Commercial	Reid and Sulman Campground (R278) and Kirkconnell Correctional Centre (R149)	Same as residential
Industrial	Bathurst Community Recycling Centre (R274), Omya Australia Pty. Ltd. (R270) and The Junktion (R273)	External noise level 75 dB(A)

25.4.3 Road traffic noise criteria

Road traffic noise assessments are based on the road type and existing noise environment, the projected activity taking into account additional project traffic generation and construction equipment, and the effects these would have on existing sensitive receivers. Road traffic noise assessment criteria for residential land uses is summarised in Table 25.8.

Table 25.8 Road traffic noise assessment criteria

Road category	Road Name	Type of Project/Development	Assessment Criteria – dBA[1]	
			Day (7am to 10pm)	Night (10pm to 7am)
Freeway, arterial, sub-arterial roads	Castlereagh Highway Great Western Highway Mid Western Highway	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	60 dB(A) $L_{Aeq(15hr)}$	55 dB(A) $L_{Aeq(15hr)}$
Local roads	Numerous	Existing residences affected by additional traffic on existing local roads generated by land use developments	55 dB(A) $L_{Aeq(1hr)}$	50 dB(A) $L_{Aeq(1hr)}$

Notes:

1: For road noise assessments, the day period is from 7am to 10pm (i.e. there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

The 'sub arterial road' category is applied to roads that connect to Castlereagh Highway, Great Western Highway and Mid Western Highway. Where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dBA according to the Road Noise Policy.

25.4.4 Operational noise criteria

Operational noise refers to the noise emissions generated by the pumping station facilities and pressure reducing system. There will be up to four pumping station facilities along the pipeline corridor, which will be either enclosed or located within a container. Project Noise Trigger Levels (PNTLs) have been determined based on the default night RBL + 5dBA, which is the worst-case scenario. The PNTLs for the pipeline corridor are summarised in Table 25.9.

Table 25.9 Operational noise assessment criteria

Receiver	Period[1]	Default RBL dB LA90	PNTL dB LAeq(15min)
All Residential	Night	30	35
Active Recreation (AR33)	When in use	N/A	53[2]
Kirkconnell Correction Centre[3]	Night	N/A	40

Note: As per Section 2.1 of the NPI, Intrusiveness Noise Levels only apply to residences.

1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

2: Includes a +3dBA adjustment to the amenity period level to convert to a fifteen-minute assessment period as per Section 2.2 of the Note NPI.

3: The applicable Amenity Noise Level (NPI Table 2.2) for the receiver area has been applied as it is a mixed-use receiver.

25.4.5 Construction vibration criteria

Sources of vibration include blasting, demolition, piling, ground treatments (compaction), construction equipment, tunnelling and industrial machinery. Construction vibration criteria have been defined in terms of cosmetic damage to buildings according to the *British Standard BS 7385:Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2"* (Table 25.11) and structural damage according to German Institute for Standardisation – DIN 4150 (2015-) Part 3 (DIN4150-3) – *Structural Vibration - Effects of Vibration on Structures* (Table 25.10).

Table 25.10 Vibration guide values – minimal risk to cosmetic damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Table 25.11 Vibration guide values – minimal risk to structural damage (safe limit values)

Line	Type of Structure	Vibration Velocity in mm/s			
		Vibration at foundation at a Frequency of:			Plane of Floor of Uppermost Storey at all Frequencies
		Less than 10Hz	10Hz to 50Hz	50Hz to 100Hz[1]	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Sensitive Buildings: Structures that because of their particular sensitivity to vibration do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note: 1: At frequencies above 100Hz, the values given in this column may be used as a minimum.

25.4.6 Blasting criteria

Blasting emissions criteria relates to the air blast overpressure and ground vibration limits stipulated in the ANZECC guidelines. Sensitive receivers may be subjected to above normal atmospheric pressure and ground vibrations that result from blasting during construction. Blasting may be required where rock is encountered along the pipeline development, but hydraulic breaking may otherwise be used in place of blasting during the construction phase. The blasting emission criteria is summarised in Table 25.12 below.

Table 25.12 Blasting emissions criteria

Receiver	Airblast Overpressure (dBZ Peak)	Ground Vibration (mm/s)	Allowable Exceedance
Any Residences on privately owned land	120	10	0%
	15	5	5% of the total number of blasts over a period of 12 months

25.5 Impact Assessment

25.5.1 Construction noise

Noise levels at the identified receivers were calculated for a worst-case scenario of all construction equipment operating simultaneously. A list of potential construction equipment and the estimated LA_{eq} dB(A) sound power level is provided in Table 15 of the NVA in Appendix AA.

Two assessment scenarios were chosen to quantify noise emissions from construction activities:

1. Transient scenarios which occur along the entire pipeline corridor and include the following construction activities:
    - clearing and grading;
    - pipeline construction (trenching); and
    - backfilling and restoration.
2. Static scenarios which occur at certain locations along the pipeline corridor and include the following construction activities:
    - vegetation clearing;
    - rock breaking;
    - underboring (river crossings, road/rail crossing or gas pipeline crossings);
    - civil, mechanical and electrical installations; and
    - excavation and establishment (for fixed infrastructure such as pumping station facilities and pressure reducing system).

Noise emissions for transient scenarios during standard construction hours and out of hours periods without additional noise mitigation or management measures at assessed receiver locations are presented in Tables 16, 17 and 18 of the NVA in Appendix AA.

The predicted construction noise levels for transient construction activities have the potential to exceed the relevant NMLs at most sensitive receivers. Predicted exceedances (based on a worst-case scenario for standard construction hours without mitigation) range from 1 dB(A) up to 46 dB(A).

Predicted noise emissions from static construction activities indicate that buffer distances are required to meet relevant noise management levels for different catchments, as shown in Table 25.13.

Table 25.13 Buffer distances to comply with noise criteria during standard hours

Catchment	Noise criteria (standard construction hours)	Minimum buffer distance*
Sunny Corner, Brewongle, Bike Park, Perthville and McPhillamys	$L_{Aeq,\ 1hr}$ 45 dB(A)	250-375 m
Yetholme	$L_{Aeq,\ 1hr}$ 57 dB(A)	60-100 m
Angus Place	$L_{Aeq,\ 1hr}$ 47 dB(A)	200-350 m

*For all static construction activities with the exception of underboring and rockbreaking

The noise results indicate that on account of buffer distances to nearest sensitive receivers, it may not be possible to conduct underboring and rock breaking in some areas of the pipeline corridor within the relevant NMLs, owing to small buffer distances. Maximum emissions also have the potential to be above the sleep disturbance screening criterion (NPI maximum of 52dB LA_{max}) at several receivers within 100 m of the pipeline corridor if out-of-hours work was undertaken.

Negotiation and notification with landholders, proactive management and adoption of specific onsite construction noise attenuation measures, limiting or staggering hours of construction, avoidance of out-of-hours work and / or adoption of alternative construction methods for managing and minimising impacts (including out-of-hours impacts) in accordance with the NVA (Appendix AA) will be required.

The highly affected $LA_{eq(15min)}$ noise management level of 75d BA is expected to be satisfied at all receivers except at one (R48 – see Figure 25.1) during all transient pipeline construction activities which include; clearing, grading, trenching and backfilling.

However, it is noted that this is a worst-case scenario and the actual magnitude of construction noise impacts will depend on a number of factors, including:

- the intensity of construction activities;
- the location of construction activities;
- the type of equipment used;
- existing local noise sources;
- intervening terrain; and
- the prevailing weather conditions.

In addition, mobile machinery will move about, altering the direction of the noise source for individual receivers. Also, during any given period, construction plant would operate at maximum sound power levels for only brief times. At other times, machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time. Finally, certain types of construction machinery would be present on site for only brief periods during construction.

It is also noted that for the majority of the pipeline corridor, potential impacts will be of short duration only. Assuming a construction rate of 40 - 80 m per day in rocky conditions (such as forestry tracks) and up to 600 - 650 m per day in open farmland, the potential for noise impacts at each identified receiver is not expected to occur for more than two weeks. Given the mobile nature of construction activities for the majority of the corridor, it is expected that sensitive receptors will only be exposed to elevated noise levels for relatively short periods.

Potential impacts will be experienced for longer periods at the stationary construction sites (such as the pumping station facilities).

The potential for construction noise impacts is a common issue with construction sites and is best addressed through the implementation of noise management measures defined by the construction environmental management plan. Feasible and reasonable mitigation measures are provided in Section 25.6.

In relation to the two heritage listed items near the corridor, no direct impacts are expected. For Leeholme Homestead and outbuildings, the pipeline corridor is on the western side of O'Connell Road, while the homestead is on the eastern side. There will be no ground disturbance impacts outside the road reserves adjacent to the two local heritage listings.

25.5.2 Construction traffic noise

The traffic and access impact assessment for the pipeline development (Ason 2019) estimates that at transient worksites (ie pipeline construction) an average of 30 truck movements per day or a peak of 14 truck movements per hour will be required.

For static worksites (ie pumping station facilities) an average of six truck movements per day or a peak of four truck movements per hour will be required. Peak light vehicle movements are estimated to be 16 vehicles per day for transient worksites and nine vehicles per day for static worksites.

Road traffic noise will be generated by an assumed 10 workers on average per shift at each activity or work area. This level of traffic will not increase existing levels by more than 2dBA, which is considered an acceptable increase in accordance with the *Road Noise Policy* (DECCW 2011a).

25.5.3 Construction vibration

A qualitative assessment of potential vibration impacts found that due to the nature of the works proposed and distances to receivers, vibration impacts from the pipeline development will be negligible.

The key vibration generating source associated with the pipeline construction is the vibratory pile driver, which generates continuous vibration during rock breaking, concrete breaking and ground demolition. The *Construction Noise Strategy* (Transport for NSW 2012) stipulates a safe working distance of 7 m between the vibration generating source and the residential receivers. Human exposure to continuous vibration is anticipated to be minimal for residential receivers assessed along the pipeline. The nearest sensitive receivers to the pipeline development are greater than 10 m away, and as result exposure to vibration is expected to be minimal. Where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved.

25.5.4 Noise and vibration due to blasting

Offset distances between the blasting site and sensitive receivers have been calculated to meet the blasting criteria. Figure 10 and Figure 11 in the NVA (refer to Appendix AA) shows the relationship between distance and the charge weight (MIC) for airblast overpressure and vibration, such that blast emissions can be estimated for receivers for when blasting is required, enabling the MIC to be adjusted so that emissions can be managed within ANZEC limits.

25.5.5 Operational noise

Noise modelling predicts that the operation of the pumping station facilities will satisfy the most conservative night criteria of 35 dB $LA_{eq(15min)}$. Noise levels are predicted to be less than 30 dB $LA_{eq(15\ min)}$ at all of sensitive receivers.

25.5.6 Operational traffic noise

Vehicle movements during operation are anticipated to be infrequent and minimal and will be less than existing traffic on the roads. Therefore, road traffic noise as a result of the operation of the pipeline is not expected to adversely impact residences.

25.6 Management and mitigation

Construction mitigation measures to be implemented are provided below. As no operational impacts are predicted, no operation measures are provided.

A noise and vibration management sub-plan will be prepared as part of the construction environmental management plan. It will include the standard measures listed in Table 25.14, as well as a complaints register and complaints handling and escalation procedures.

The noise management sub-plan will include strategies to minimise noise impacts on sensitive noise receivers, including the following:

- ensure that construction activities meet construction NMLs within the allowable hours of operation as far as practicable;
- where feasible, avoid completing construction activities adjacent to residential receivers between 6pm to 7am (especially vegetation clearing and rock breaking);
- where noise levels are above relevant NMLs, implement reasonable and feasible best practice noise controls to minimise noise emissions and/or exposure duration at affected receivers; and
- where the use of best practice noise controls does not adequately address exceedance of noise management levels, adopt alternative measures to minimise impacts on the community.

Table 25.14 General measures to manage potential noise and vibration impacts for the pipeline development

Category	Management measures
General construction noise management measures	Plant on site will be positioned to reduce the emission of noise to the surrounding areas and to site personnel. Any equipment not in use for extended periods will be switched off. Plant and equipment fitted with appropriate mufflers, louvres and enclosures where necessary.
Traffic noise mitigation	To minimise access road noise impacts, the following feasible and reasonable noise mitigation options will be considered: • Appropriate location of private access roads to the construction sites. • Regulating time of use. • Using clustering. • Engine brakes would be minimised in residential areas.
Blasting	If required, blasting noise and vibration levels may be reduced by application of the following: • Investigate alternative rock-breaking techniques. • Establish times of blasting to suit local conditions. Building condition surveys will be undertaken at all potentially impacted dwellings (within 50 m of the pipeline), prior to commencement of blasting. These would be repeated at works completion. Blasting design configuration.
Vibration	For construction activities undertaken in close proximity to dwellings: • A dilapidation report on the state of buildings within 50 m of the construction zone will be prepared before and after construction.

Table 25.14 General measures to manage potential noise and vibration impacts for the pipeline development

Category	Management measures
Community liaison	A management procedure will be put in place to deal with noise complaints that may arise from construction activities. Each complaint will be investigated, and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
	Provide the community, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. This can be provided through media such as letterbox drops, meetings, a dedicated website or individual contact.
	Good communication with residents in the vicinity of the construction site will be established at the beginning of construction and maintained throughout. This will involve keeping people informed of progress and appropriate dealing with complaints.
	With respect to respite periods, liaison with affected residences to identify least affected periods and the best timing for implementing respite periods should be considered.

The Australian Standard AS 2436-2010 (R2016) *Guide to Noise Control on Construction, Maintenance and Demolition Sites* also sets out numerous practical recommendations to assist in mitigating construction noise emissions. These recommendations include operational strategies, source noise control strategies, noise barrier control strategies, and community consultation, and will be implemented as required.

Ongoing noise monitoring, reporting and complaint handling will be implemented as site procedures during the construction of the pipeline development. Any noise issues identified will be documented and forwarded to the construction manager to respond.

25.7 Conclusions

The construction noise levels for most activities associated with the pipeline installation have the potential to be above the relevant noise criteria (NMLs) at most receivers in close proximity to the corridor, although for the most part are expected to be only for a short duration (ie either one to two shifts or up to a few days).

The noise levels at one receiver (R48 on Pipers Flat Road in Portland) are predicted to exceed the highly noise affected level, as specified in the ICNG, of 75 dB(A). This house is within 50 m of the pipeline alignment. In accordance with the requirements of the ICNG, respite periods may be required for this property.

Although construction noise will generally be temporary and localised in nature, the potential impacts will be managed through the implementation of noise control measures outlined in section 25.6, particularly during noise intensive works when they are in close proximity to houses (<200 m).

Operational noise emissions from the pumping station facilities are anticipated to be negligible at adjacent receivers to each site, although assumes some form of container or enclosure is adopted for each pumping station.

Noise management and mitigation measures will be implemented during the construction of the pipeline development, and these measures, along with ongoing monitoring, reporting and complaint handling procedures, will be documented in the CEMP.

Chapter 26

Air quality and greenhouse gas

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26 Air quality and greenhouse gas

26.1 Introduction

This chapter provides an assessment of the air quality impacts and predicted greenhouse gas emissions associated with the pipeline development.

The EARs relevant to the pipeline air quality and greenhouse gas impact assessment are detailed in Table 26.1.

Table 26.1 Air quality and greenhouse gas related EARs for the pipeline development

Requirements	Where addressed
an assessment of the likely air quality impacts of the development, including cumulative impacts from nearby developments, in accordance with the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*, and having regard to the NSW Government's *Voluntary Land Acquisition and Mitigation Policy;*	Section 26.4
an assessment of the likely greenhouse gas impacts of the development;	Section 26.5 and 26.6
a description of the feasibility of measures that will be implemented to monitor and report on the emissions (including fugitive dust and greenhouse gases) of the development.	Section 26.7

26.2 Existing environment

The existing land use around Lithgow, Bathurst and Blayney is mainly pastoralism, agricultural and forestry. Air quality around the pipeline development is generally rated as 'good' because of the rural environment with little urban or industrial air pollution sources. The main contributor to reduced air quality is from the Mount Piper Power Station and the coal loading facilities at SCSO.

26.2.1 Nearest receptors

There are approximately 84 sensitive receivers within 200 m of the pipeline corridor, of which approximately 77 are residential. Approximately 21 of these are within 50 m or less from the pipeline corridor. The closest sensitive receivers to the pipeline corridor are located around pumping station facility No.2, areas south of Portland, Sunny Corner Road near the Kirkconnell Correctional Centre, the Great Western Highway, Tarana Road, White Rock Road and Montavella Road. Sensitive receivers are shown on Figure 25.1 in Chapter 25.

26.3 Methodology

26.3.1 Air quality assessment methodology

In order to assess the air quality impact potential of the proposed construction phase of the pipeline, a qualitative impact assessment has been undertaken. While no specific methodology for such an assessment is available in Australia, the United Kingdom-based Institute of Air Quality Management (IAQM) has prepared the *Guidance on the Assessment of Dust from Demolition and Construction* (hereafter GADDC, IAQM 2014).

The GADDC has been applied for construction projects in NSW and accepted by the EPA as a progressive approach to assessing the particulate matter impact risk associated with short-term construction and demolition projects.

The key steps to the GADDC approach in assessing air quality risks from construction and demolition projects are as follows:

- STEP 1 – screen requirement for a more detailed assessment based on proximity of surrounding receptors;
- STEP 2 – assess the risk of dust impacts from demolition, earthworks, construction and truck movements and the sensitivity of surrounding receptors;
- STEP 3 – determine the site-specific mitigation for each of the four potential activities in STEP 2;
- STEP 4 – examine the residual effects and determine significance; and
- STEP 5 – prepare dust assessment report.

Section 26.7.1 documents the construction dust assessment, conducted in accordance with the GADDC.

There will be no significant emission source of air pollutants associated with the operation of the pipeline and consequently there is negligible potential for air quality impacts in the surrounding environment. No further assessment of operational phase emissions has been completed.

26.3.2 Greenhouse gas assessment methodology

As for the mine development component of the project, the estimation of greenhouse gas (GHG) emissions from the pipeline development was based on the National Greenhouse Accounts Factors (NGAF) workbook (DoEE 2018). A description of this methodology is contained in Section 12.1 of this EIS.

26.4 Air quality impact assessment

26.4.1 Step 1 - Screen the need for a detailed assessment

Screening criteria for a detailed assessment is presented in Box 1 of Section 6 of the GADDC. The IAQM specify that if a human receptor is located within 350 m of the boundary of a site, or within 50 m of a route used by construction vehicles up to 500 m from site entrance, then a detailed construction dust assessment should be undertaken.

The alignment of the proposed pipeline was reviewed for sensitive receptor locations located within 350 m of the pipeline construction corridor, with the following receptor counts returned:

- 113 receptors within 350 m;
- 69 receptors within 200 m;
- 29 receptors within 100 m;
- 17 receptors within 50 m; and
- 2 receptors within 20 m.

Consequently, the proposed construction activities trigger the GADDC criteria to undertake a more detailed assessment of dust impacts from proposed construction activities.

26.4.2 Step 2 - Assess the risk of dust impacts

The GADDC identifies that the risk category for dust impacts from construction activities should be allocated based on the following factors:

- the scale and nature of works (STEP 2A); and
- the sensitivity of the area to dust impacts (STEP 2B).

These factors are then combined to determine the risk of impacts from the works (STEP 2C). The risk rating process is addressed in the following sections.

i STEP 2A – Scale and nature of works

Section 7.2 of the GADDC requires that in allocating dust impact risk, the scale and nature of the following components are to be determined:

- demolition;
- earthworks;
- construction; and
- truck track out.

The GADDC prescribes a range of criteria that classify the magnitude of each activity as either large, medium or small. The proposed activities relevant to each component have been reviewed in order to allocate a dust emission magnitude in accordance with the GADDC guidance. The allocated dust emission magnitude ratings are presented in the following sections.

a Demolition phase

There are no significant demolition activities associated with the construction of the project. Consequently, a 'negligible' dust emission magnitude rating has been allocated.

b Earthworks phase

The earthworks phase of the project will involve clearing and grading of the pumping station facility compounds, clearing, open trenching and backfilling of material along the entire pipeline corridor and establishing entry and exit pits for underboring works.

For conservatism, the assessment assumed a 20 m width of disturbance along the length of the pipeline corridor. This combined with the anticipated amount of material that will be excavated resulted in the pipeline development being allocated a 'large' dust emission magnitude rating under the GADDC classification criteria.

c Construction phase

There are limited built structures associated with the proposed pipeline development. The pipeline segments will be laid in the excavated trench and backfilled. There will be built structures associated with the pumping station facilities; however, these will be of low volume and constructed with materials with low potential for dust generation (bricks, metal).

Based the GADDC classification criteria, a dust emission magnitude rating of 'small' is allocated to the construction phase of the pipeline development.

d Truck trackout

The majority of truck movements associated with the pipeline construction will be associated with the delivery of pipeline segments and raw materials. The majority of excavated material will be stockpiled at the active area of earthworks for backfilling. Consequently, there is limited potential for truck trackout associated with the proposed pipeline.

Based on the above and the GADDC classification criteria, a dust emission magnitude rating of 'small' is allocated to the truck trackout of dust to public roads from the project.

e Summary of dust emission magnitude

The allocated dust emission magnitude ratings assigned to the four general components of the construction project are summarised in Table 26.2.

Table 26.2 Summary of dust emission magnitude

Activity	Dust emission magnitude
Demolition	Negligible
Earthworks	Large
Construction	Small
Truck trackout	Small

ii STEP 2B – Sensitivity of the surrounding environment

Section 7.3 of the GADDC details the approach to categorise the sensitivity of the surrounding environment reviewing the following factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors; and
- local ambient concentrations of particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) and likelihood of impact to human health.

a Specific sensitivities of receptors in the area

Section 7.3 of the GADDC provides classification definitions of receptor sensitivities to dust soiling, human health and ecological effects. The classification definitions in the GADDC were used to classify the sensitivity of receptors in the vicinity of the proposed pipeline alignment.

For dust soiling effects, receptors in the area were allocated a high sensitivity rating, on the basis that:

- receptors are largely residential, where residences can reasonably expect enjoyment of a high level of amenity; or
- the appearance, aesthetics or value of their property would be diminished by soiling.

For human health effects, as receptors along the pipeline are generally residential, a high sensitivity rating has been allocated.

In addition to human receptors, the area was allocated a ‘medium’ sensitivity rating for ecological receptors along the pipeline alignment on the basis of the GADDC criteria.

b Proximity and number of receptors in the area

As stated in Section 26.4.1, review of receptors along the pipeline alignment the local area highlights that there are more than 100 human receptors located 350 m of the construction footprint.

In addition to human receptors, the pipeline passes within 50 m of potentially sensitive ecological receptors.

c Sensitivity rating of the local area to dust soiling effects

Combining the receptor sensitivity to dust soiling effects (high as per Section 26.4.2(ii)(c))) with the criteria listed in Table 26.3 (as documented in Table 2 the GADDC), a sensitivity to dust soiling effects in people and property of ‘high’ is allocated for the area along the construction alignment.

Table 26.3 Sensitivity rating of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Notes: Table source: Table 2 of GADDC

d Local ambient concentrations of PM_{10} and sensitivity of area to human health impacts

As presented in Section 11.2, baseline air quality for the project area has been characterised using data from the BCD (formally OEH) air quality monitoring station at Bathurst and the Regis-maintained network at the mine site. The average PM_{10} concentration adopted as baseline (Section 11.3.3) is 14.1 µg/m³, which is considered to be applicable for characterising baseline air quality along the pipeline corridor.

Combining the receptor sensitivity to human health effects (high as per Section 26.4.2(ii)(d)) with the criteria listed in Table 26.4 (as documented in Table 3 the GADDC), a sensitivity to human health impacts of ‘high’ is allocated for the area along the pipeline corridor.

Table 26.4 Sensitivity of the area to human health impacts

Receptor sensitivity	Annual mean PM_{10} concentration	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	22 - 25 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	19 - 22 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<19 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	22 - 25 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	19 - 22 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<19 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Notes: Table source: Table 3 of GADDC. It is noted that the PM_{10} concentrations have been adjusted from the GADDC to meet the NSW EPA criteria for annual average PM_{10}.

e Sensitivities to ecological effects

As identified in Section 26.4.2.ii.b, there are potential sensitive ecological receptors located within 50 m of the proposed pipeline alignment. The sensitivity of the ecological receptors to dust impacts is unknown. Consequently in accordance with the GADDC criteria, the sensitivity of the local area to ecological effects is classified as 'medium'.

f Summary of sensitivity classification

The sensitivity of the area surrounding construction activities, based on the previous sections, is summarised in Table 26.5.

iii STEP 2C – Define the risk of impacts

To determine the risk of impacts with no mitigation applied, Section 7.4 of the GADDC requires that the dust magnitude rating (refer Table 26.2) is combined with the sensitivity of receptors in the surrounding area (refer Table 26.5) for each of the four activity categories (ie demolition, earthworks, construction and truck trackout). Using the lookup tables in Section 7.4 of the GADDC, dust impact risk ratings for each section of the construction project were allocated and are presented in Table 26.5.

Table 26.5 Summary of sensitivity analysis of receptors in surrounding area

Activity	Sensitivity of surrounding area			
	Demolition	Earthworks	Construction	Truck trackout
Dust soiling	Negligible	Medium	Low	Negligible
Human health	Negligible	Low	Negligible	Negligible
Ecological	Negligible	Low	Negligible	Negligible

As detailed in Table 26.5, the risk rating for dust impacts to human health and ecological receptors from the demolition, construction and truck trackout phases of the pipeline construction, prior to the application of dust mitigation measures, ranges between negligible and low. An impact risk rating of medium is allocated for earthworks activities for dust soiling.

Mitigation measures to alleviate the residual risk of dust soiling during the earthworks phase are presented in Section 26.7.1.

26.5 Greenhouse gas assessment

26.5.1 GHG emission sources

The GHG emission sources included in this assessment are listed in Table 26.6Table 12.2, representing the most significant sources associated with the pipeline development. Emissions of GHGs have been quantified on an annual basis accounting for the construction, operational and decommissioning phases of the pipeline development.

GHG emissions from the pipeline development are estimated using the methodologies outlined in the NGAF workbook, using fuel energy contents and Scope 1, 2 and 3 emission factors for diesel and electricity use in NSW.

Table 26.6 Scope 1, 2 and 3 emission sources

Scope 1	Scope 2	Scope 3
Direct emissions from fuel combustion (diesel) by construction plant and equipment.	Indirect emissions associated with the consumption of purchased electricity by pumping stations (operational phase)	Indirect upstream emissions from the extraction, production and transport of diesel and petrol (construction)
		Indirect upstream emissions from electricity lost in delivery in the transmission and distribution network (operational)

26.5.2 Excluded emissions

There are a number of GHG emissions that are considered minor relative to the emission sources listed in Section 2.5.3 and have been excluded from this GHG assessment.

These include:

- fugitive leaks from high voltage switch gear and refrigeration (Scope 1);
- land use change and land clearing (Scope 1);
- delivery of pipeline segments and raw materials to site (Scope 3);
- disposal of solid waste at landfill (Scope 3); and
- travel of employees to and from the construction works (Scope 3).

26.5.3 Activity data

Estimates of annual diesel and electricity consumption associated with the pipeline development are as follows:

- total construction phase diesel consumption – 350.8 kL; and
- annual electricity consumption by pumping station facilities – 2,365,200 kWh/year.

Diesel consumption was estimated using the likely equipment fleet and associated manufacturer diesel consumption rates. The construction phase of the pipeline is anticipated to continue for a period of approximately 12 months, the total diesel combustion listed above has been assumed as a 12-month total for a conservative estimate of annual GHG emissions. Electricity consumption was estimated by upscaling the pumping station facility electricity consumption from a 5 ML/day water pipeline in the Southern Highlands of NSW (GHD 2010) to the anticipated 13.5 ML/day pumping rate for the pipeline development.

26.6 Emission estimates

The following emission factors have been used to estimate GHG emissions from the project:

- diesel consumption during construction (Scope 1) – diesel oil factors from Table 3 of the NGAF workbook (2018);
- electricity consumption by pumping stations (Scope 2) – NSW Scope 2 emission factor from Table 5 of the NGAF workbook (2018);
- diesel consumption during construction (Scope 3) – diesel oil factor from Table 40 of the NGAF workbook (2018); and
- electricity consumption by pumping stations (Scope 3) - NSW Scope 3 emission factor from Table 41 of the NGAF workbook (2018).

The estimated annual GHG emissions for construction and operations of the pipeline development are presented in Table 26.7.

Table 26.7 Calculated GHG emission totals

Pipeline development phase	Annual GHG emissions (t CO_2-e/year)			Total (Scope 1, 2 and 3) pipeline development GHG emissions relative to:	
	Scope 1	Scope 2	Scope 3	NSW 2017 annual emissions	Australia 2017 annual emissions
Construction	950.7	-	48.8	0.00078%	0.00019%
Operation	-	1,939.5	236.5	0.00169%	0.00041%

The significance of GHG emissions from the construction and operational phases of the pipeline development relative to state and national GHG emissions has been quantified by comparing annual average GHG emissions against the most recent available total GHG emissions inventories (calendar year 2017[10]) for NSW (128,780.2 kt CO_2-e) and Australia (530,840.9 kt CO_2-e).

Total (Scope 1, 2 and 3) GHG emissions generated by the pipeline development range from 0.00077% (construction) to 0.00167% (operation) of NSW total GHG emissions and from 0.000019% (construction) to 0.00041% (operation) of Australian total GHG emissions, based on the National Greenhouse Gas Inventory for 2017.

The contribution of the pipeline development to projected climate change, and the associated environmental impacts, would be in proportion with its contribution to global greenhouse gas emissions.

26.7 Emissions management

26.7.1 Construction dust emissions

As stated, the dust impact risk allocation in Section 26.3**Error! Reference source not found.** relates to unmitigated construction dust emissions. Although the risk rating for dust impacts from the various construction phases of the pipeline ranges from negligible to medium, the following measures could be implemented throughout the construction phase to further reduce the residual risk of impacts to the surrounding area:

- prior to commencement of construction activities, develop appropriate communications to notify the potentially impacted residences of the project (duration, types of works, etc) and provide relevant contact details for environmental complaints reporting;
- maintain a dust complaints log book throughout the construction phase, which identifies the cause(s) and appropriate measures taken to reduce emissions;
- record any exceptional incidents that cause dust and/or air emissions, either on or off-site, and the action taken to resolve the situation in the log book;
- carry out regular site inspections, record inspection results, and make the log book available for review as requested;
- keep any site fencing and barriers clean using wet methods;

10 http://ageis.climatechange.gov.au/

- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site;
- impose a maximum-speed-limit of 20 km/h in the vicinity of work areas;
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- ensure proper maintenance and tuning of all plant and equipment engines;
- provide an adequate water supply on the construction site for effective dust/particulate matter suppression/ mitigation;
- minimise drop heights from loading or handling equipment as much as practicable; and
- only remove vegetation/ground cover in small areas during work, as practicable.

26.7.2 GHG emissions

GHG emissions from the pipeline development are principally associated with energy consumption, specifically diesel combustion during the construction phase and consumption of purchased electricity by pumping station facilities during the operational phase. Due to the location and nature of the construction works, the development is dependent on the use of diesel-powered equipment. The pumping station facilities for the pipeline development require electricity supply to operate. Consequently, the ability to eliminate these measures is limited.

Mitigation measures relating to diesel fuel consumption and electricity use should therefore be the focus in minimising GHG emissions from the pipeline development. Measures may include:

- routine maintenance of equipment fleet to ensure optimal engine operation;
- minimise engine idling wherever practical;
- use of alternative energy sources where feasible, such as onsite solar power; and
- sourcing of purchased electricity from renewable generation sources.

26.8 Conclusion

The risk rating for dust impacts to human health and ecological receptors from the demolition, construction and truck trackout phases of the pipeline construction, prior to the application of dust mitigation measures, ranges between negligible and low. An impact risk rating of medium is allocated for earthworks activities for dust soiling.

GHG emissions from the pipeline development are principally associated with energy consumption, specifically diesel combustion during the construction phase and consumption of purchased electricity by pumping station facilities during the operational phase.

A number of measures will be implemented during the construction of the pipeline to monitor and report on the associated emissions (including dust and greenhouse gases).

Chapter 27

Biodiversity

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27 Biodiversity

27.1 Introduction

This chapter provides a summary of the Biodiversity Development Assessment Report (BDAR) prepared for the pipeline development by OzArk (2019). The BDAR is contained in Appendix Y. Biodiversity impacts related to the pipeline development have been assessed in accordance with the NSW Biodiversity Assessment Method (BAM) established under the BC Act.

The EARs require biodiversity impacts from the construction and operation of the pipeline development to be assessed in accordance with the relevant requirements detailed in Table 27.1.

Table 27.1 Biodiversity related EARs for the pipeline development

Requirement	Where addressed
an assessment of the direct and indirect biodiversity impacts of the development throughout its life, and impacts on biodiversity values in the region, which: for the water supply pipeline is assessed in a Biodiversity Development Assessment Report in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016 (NSW),* the *Biodiversity Assessment Method,* and includes a strategy to offset any residual impacts in accordance with *the Biodiversity Conservation Act 2016 (NSW);*	Appendix Y Section 26.4
an assessment of the likely impacts of the development on aquatic ecology and key Fisheries issues, including Aquatic Biodiversity and Key Fish Habitats;	Appendix Y (section 3.4 and 6.2). Section 27.5.3
an assessment of impacts to koalas and koala habitat in accordance with *State Environmental Planning Policy No.* 44 - *Koala Habitat Protection;* and	Appendix Y (section 7.2) Section 27.3.5
a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time;	Appendix Y (section 8) Section 27.4 and 27.6

27.2 Methodology

The BAM broadly requires an assessment of biodiversity values, determination of the impacts and quantification of the biodiversity credits required to offset the residual impacts. The study area for the assessment was defined as the centreline of the pipeline buffered by an area 500 m either side, in accordance with the BAM stipulated buffer for linear developments.

The BDAR assessment was conducted in three stages:

- stage 1 – desktop assessment from a variety of existing information sources to:
  - contextualise the study area;
  - identify entities for targeted surveys,
  - predict possible constraints; and
  - refine survey methodology.

- stage 2 – biodiversity assessment (field survey) involving assessment of:
  - landscape features and context;
  - native vegetation and threatened ecological communities and vegetation integrity; and
  - the habitat suitability for threatened species and populations.
- stage 3 – impact assessment involving consideration of:
  - avoiding and minimising impacts on biodiversity values;
  - assessing the impacts and offset thresholds; and
  - calculating the offset requirements.

Field surveys were conducted in August, September, October and December 2018, and January and May 2019. The entire pipeline corridor was traversed either by foot, where native vegetation was found to be present, or by vehicle.

The data from the desktop review and field surveys was collated to assess the impact of the pipeline development on native vegetation, threatened species and ecological communities. The data was also used as input into the BAM calculator to calculate biodiversity credits that must be offset in relation to the pipeline development.

Further details on the methodology adopted for the biodiversity assessment is provided in Appendix Y.

27.3 Existing environment

27.3.1 The BAM bioregions and landscape features

i Bioregions

The pipeline corridor is located wholly within the South Eastern Highlands Bioregion, according to the Interim Biogeographic Regionalisation of Australia V7 (IBRA). This includes four sub-regions – Orange, Bathurst, Hill End and Capertee Uplands. A small portion of the study area is within the Sydney Basin Bioregion at the eastern end of the pipeline corridor.

ii Mitchell landscapes

The Mitchell landscapes further classify the landscape of the bioregion. The pipeline corridor incorporates the following Mitchell landscapes and areas:

- Capertee Plateau;
- Upper Macquarie Channels and Floodplains;
- Mount Horrible Plateau;
- Macquarie Valley Basalts;
- Bathurst Granites; and
- Rockley Plains.

iii Landscape features

Large areas of the pipeline corridor and study area are non-native vegetation comprised of cleared agricultural land used for grazing and cropping and Radiata Pine (*Pinus radiata*) plantations within state forests.

The pipeline corridor has been selected to avoid rocky outcrops and significant geological features and does not traverse across any cave or karst systems. There are extensive areas of sandstone cliffs and gorges of the Capertee Uplands IBRA subregion towards the east of the study area, but none are located within the pipeline corridor.

The eastern end the pipeline corridor (including three pumping station facilities) is partly within highly disturbed areas associated with mining and industrial activities at Angus Place and SCSO and the Mount Piper Power Station.

The pipeline corridor crosses a number of watercourses varying in Strahler order number, including the Macquarie River and Queen Charlottes Creek which are permanent streams.

No wetlands of international importance occur within the study area. Wetlands in the study area are limited to artificially created dams and reservoirs and those created within abandoned quarry and mine pits at the eastern end of the pipeline corridor.

The areas of native vegetation and watercourses provide connectivity for biodiversity, although riparian vegetation on the larger rivers is often dominated by non-native pasture and non-native trees such as Crack-Willow.

No declared areas of outstanding biodiversity value occur within the study area.

27.3.2 Vegetation

At vegetation assessment locations, 20 m x 20 m floristic plots within larger 50 m x 20 m habitat plots were used to collect data on floristic composition, structure and habitat function, including the presence of any of the threatened plant species deemed likely to be present based on the desktop assessment. The location of the plots and the detailed survey methodology are set out in Appendix Y (sections 4.1 and 5.3.1 and Appendix 4).

At the time of the field survey climatic conditions were dryer than average. Vegetation condition was symptomatic of these dry conditions, which resulted in fewer ground layer plants; field surveys identified a low diversity of both native and non-native species. Combined with much of the corridor being heavily grazed, this made species identification, particularly of grasses difficult. Consequently, the diversity and abundance of understorey species is under-represented in the vegetation assessment data recorded in the corridor.

i Vegetation extent and condition

The native vegetation of the study area consists of areas of paddock trees over exotic pasture, open woodlands in the west and forests in the higher altitude of the east. The area of native vegetation cover within the pipeline corridor is 8.51 ha (6.7% of the pipeline corridor), of which the condition state for 2.88 ha is classified as ‘good’, 0.98 ha is classified as ‘moderate’ and 4.65 ha is classified as ‘poor’. Non-native vegetation within the pipeline corridor is 83.2 ha.

ii Plant community types

Two hundred and fifty-three plant species and twelve plant community types (PCTs), as classified by OEH (2018), were recorded during the field survey of pipeline corridor. These are summarised in the BDAR (Appendix Y) and PCTs are summarised in Table 27.2.

Table 27.2 Plant community types (PCTs), vegetation formation and area in the pipeline corridor

PCT ID	PCT Name	Vegetation formation	Area along pipeline corridor (ha)
85	River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	Forested wetlands	0.09
287	Long-leaved Box - Red Box - Red Stringybark mixed open forest on hills and hillslopes in the NSW South Western Slopes Bioregion.	Dry Sclerophyll Forests (Shrubby sub-formation)	0.74
654	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion.	Grassy woodlands	0.65
679	Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy woodlands	0.36
727	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	0.01
731	Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Grassy woodlands	2.46
732	Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	Grassy woodlands	1.09
765	Carex - Juncus sedgeland/wet grassland of the South Eastern Highlands Bioregion	Freshwater Wetlands	0.01
1093	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Dry Sclerophyll Forest (Shrubby sub-formation)	2.19
1191	Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Grassy woodlands	0.03
1197	Snow Gum - Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion	Wet Sclerophyll Forests (Grassy sub-formation)	0.32
1330	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Grassy Woodlands	0.56
	Total native vegetation		**8.51 ha**

iii Threatened ecological communities

Four threatened ecological communities (TEC) are potentially associated with the PCTs identified within the pipeline corridor; however, based on condition and locational threshold requirements, only two TECs are present in the corridor (refer to Table 27.3).

Of the two TECs, one: White Box – Yellow Box – Blakely's Red Gum Woodland is listed under the BC Act as an Endangered Ecological Community (EEC), and the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Grassland community is listed under the EPBC Act as a critically endangered ecological community (CEEC).

Table 27.3 Determination of threatened ecological communities in the pipeline corridor

TEC	BC Act[1]	EPBC Act[2]	TEC present	Area (ha) and condition state
White Box - Yellow Box - Blakely's Red Gum Woodland	EEC	-	***Yes***	Moderate 0.46 ha Poor 0.75 ha
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland	-	CEEC	***Yes***	Moderate 0.32 ha
Tablelands Snow Gum - Black Sallee - Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW Western Slopes Bioregions.	EEC	-	No. All associated PCT within the pipeline corridor are not within the Orange IBRA.	n/a
Tableland Basalt Forest of the Sydney Basin and South Eastern Highlands Bioregions	EEC	-	No. Occurs outside the altitudinal range of the EEC.	n/a

Notes:
1: BC Act: Endangered Ecological Community (EEC)
2: EPBC Act: Critically Endangered Ecological Community (CEEC)
-: not listed
n/a: not applicable

27.3.3 Threatened species

i Ecosystem credit species surveys

Ecosystem species can reliably be predicted as occurring based on habitat. Under the BAM, there is no requirement to survey for these species. Offsetting requirements for impacts to ecosystem species is considered by the BAM within the ecosystem credit calculations. Based on the location of the pipeline corridor and the PCT and habitat attributes occurring, 33 ecosystem credit species are predicted to occur.

Six ecosystem credit species listed under the BC Act were recorded opportunistically during survey periods:

- Gang Cockatoo;
- Dusky Woodswallow;
- Spotted Harrier;
- Little Eagle;
- Flame Robin; and
- Capertee Stringybark.

The location of these sightings is shown in Appendix 4 of the BDAR (contained in Appendix Y).

ii Candidate species credit species

Other threatened species, identified as “species credit” species, cannot confidently be predicted by vegetation surrogates and landscape features, but can be reliably detected by targeted surveys. Sometimes the same species can be assumed present in the “ecosystem credits” as foraging and can also require assessment as a “species credit” species for breeding. Assumed presence for foraging does not equate to an assumed presence for breeding, unless targeted surveys indicate suitable breeding sites or nests within the development area.

The assessment identified 43 candidate species predicted to occur along the pipeline corridor based on the location and the PCTs present. According to the BAM, if suitable habitat for these species occurs on the pipeline corridor, they must be the subject of targeted survey according to recommended guidelines or else assumed present. After consideration of habitat constraints, 22 species could be immediately discounted due to unsuitable habitat or distribution, while 20 species credit species have potential to occur and required targeted survey and/or habitat assessment in accordance with the BAM. Ten of these species were surveyed and the remaining ten were assumed present (see Appendix Y, Table 5.4).

a Flora

Targeted surveys were carried out for threatened plant species where suitable habitat occurred. No species credit plant species were recorded on the pipeline corridor. However, due to the dry climatic conditions and the difficulty of detecting ground layer plants, two species were assumed present within areas of suitable habitat, being Silky Swainson-pea and Austral Toadflax.

b Fauna

Due to the logistical constraints associated with the 90 km pipeline length, limited targeted surveys for threatened fauna were undertaken. Where targeted surveys were not carried out, species have been assumed as present where suitable habitat exists on the pipeline corridor. Accordingly, eight candidate fauna species were assumed present:

- Eastern Pygmy Possum;
- Southern Myotis;
- Purple Copper Butterfly;
- Squirrel Glider;
- Brush-tailed Phascogale;
- Masked Owl;
- Barking Owl; and
- Powerful Owl.

27.3.4 Non-native vegetation and weeds

Much of the pipeline corridor is an agricultural landscape with large areas of non-native grazing pasture and cropping. 83.2 ha of non-native vegetation occurs within the pipeline corridor. The eastern portion of the pipeline corridor contains large areas of State forest under Radiata Pine cultivation. 83 non-native plants were recorded in the pipeline corridor.

Fourteen non-native plants (weeds) which the BAM considers to be high threat weeds were recorded in the pipeline corridor during the field survey. Of these:

- St John's Wort, African Boxthorn, Blackberry and Scotch Broom are listed under the *Biosecurity Act 2015* as priority weeds for the Central Tablelands Local Land Services Region; and
- African Boxthorn, Crack Willow, Blackberry and Scotch Broom are listed as weeds of national significance.

27.3.5 Koala habitat protection – SEPP 44

Lithgow, Bathurst and Blayney LGAs are listed under Schedule 1 of the *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44) as LGAs to which SEPP 44 applies. Targeted surveys were carried out for Koala within the pipeline corridor and no foraging or breeding Koala were detected. Only one tree species listed in Schedule 2 of the SEPP as a feed tree (Ribbon Gum (*Eucalyptus viminalis*)) was recorded. The lack of suitable habitat and the disturbed nature of the study area indicates that the pipeline corridor is not core Koala habitat. The pipeline development does not require the removal of mature trees that might be important for foraging Koala.

27.3.6 Matters of National Environmental Significance

The EPBC Act Protected Matters Search Tool identified 26 threatened species which are known or may occur in the pipeline corridor where suitable habitat was present (see Appendix Y). None were observed during field assessment. On the basis of habitats and habitat features confirmed by site survey, assessments of significance were conducted for ten threatened species on account of possible site utilisation:

- Regent Honeyeater;
- Swift Parrot;
- Spotted-tailed Quoll;
- Painted Honeyeater;
- Koala;
- Superb Parrot;
- Grey-headed Flying Fox;
- Purple Copper Butterfly;
- Austral Toadflax; and
- Macquarie Perch.

As noted in Section 27.3.2, the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Grassland community is also listed under the EPBC Act as a CEEC.

27.3.7 Aquatic environment

The pipeline corridor crosses or runs along the banks of 112 watercourses and all known water crossings were investigated during the field survey. Data was collected to confirm habitat values such as water source permanence, aquatic vegetation and in-stream snags and rocks at crossings.

i Key fish habitat

Twenty-six watercourses crossed by the pipeline corridor are mapped as key fish habitat (KFH) by DPI Fisheries' predictive mapping and set out in Appendix Y (BDAR Appendix 1). KFH is summarised in detail in Appendix Y (Table 3.4) providing a sensitivity classification and a classification of each waterway for fish passage. It was found that 21 of the 26 watercourses met the criteria for KFH.

- KFH sensitivity types included:
  - five highly sensitive watercourses (Macquarie River, Saltwater Creek, Kirkconnell Creek, Pipers Flat Creek, Wangcol Creek);
  - four moderately sensitive watercourses (Evans Plains Creek, Queen Charlottes Creek, Willawa Creek, Coxs River);
  - 14 minimally sensitive watercourses; and
  - three not regarded as KFH;
- KFH water class (fish passage) types included:
  - one class 1 major KFH (Macquarie River);
  - eight class 2 moderate KFH (Evans Plains Creek, Queen Charlottes Creek, Saltwater Creek, Kirkconnell Creek, Willawa Creek, Pipers Flat Creek, Wangcol Creek, Coxs River);
  - seven class 3 minimal KFH;
  - seven class 4 unlikely KFH; and
  - three not regarded as KFH.

ii Wetlands

The wetlands affected by the pipeline corridor comprise of artificial dams and reservoirs and within abandoned quarry and mine pits in the eastern section of the study area. The Directory of Important Wetlands of Australia indicates there are no listed important wetlands in the study area.

iii Threatened and endangered aquatic species and communities

Indicative distribution mapping of threatened fish provided by the NSW Department of Primary Industries indicates that several steams crossed by the pipeline corridor are potential habitat for two threatened fish species:

- the Macquarie Perch, which is known to occur only in the Macquarie River upstream of Bathurst. The pipeline corridor intersects this part of the river; and

- the Purple-spotted Gudgeon, listed as endangered under the FM Act, is more widely distributed within more permanent watercourses.

There are no aquatic endangered ecological communities within the study area.

27.3.8 Groundwater dependent ecosystems

The groundwater dependent ecosystems (GDE) atlas indicates that several watercourses within the study area have a high potential for the occurrence of GDEs; however, many of these watercourses are ephemeral, and no evidence of groundwater flow was identified during field work. The mapping does not encompass any terrestrial GDEs suggesting there is a low to moderate potential for these to occur in the study area. Any GDEs are likely limited to terrestrial vegetation within the riparian corridor that opportunistically access groundwater under dry conditions.

27.4 Avoiding and minimising impacts

The BAM places particular emphasis on avoiding and minimising impacts on native vegetation and habitat during project planning, with knowledge of biodiversity values influencing the project location. The desktop assessment of biodiversity values which provided the initial information to plan the route has been supplemented by field surveys which have resulted in many changes to both the route and the width of the pipeline corridor. The final selection of the pipeline route has been an iterative process informed by field surveys and landscape and habitat values to avoid impacts as far as possible.

As outlined in Chapter 6, the pipeline route was originally planned to largely follow the APA gas pipeline easement and Transgrid easements; however, once the utilities had advised that the pipeline development would need to lie beyond the boundaries of their easements, it became clear that this would involve significant removal of native vegetation. The alternative location selected mostly follows roads and tracks and open grazing land to minimise impacts to native vegetation and habitat.

Part of the route near the Sunny Corner State Forest which would have provided better gradients for the pipeline was abandoned due to the significant presence of the host plants (*Bursaria spinosa*) of the Purple Copper Butterfly.

Furthermore, the pipeline development has adopted many measures to avoid impacts, such as the following:

- The pipeline corridor traverses large extents of cleared agricultural land and timber plantations of Radiata Pine without any native vegetation present. Where possible, the pipeline will be trenched into existing roads and tracks, minimising impact to native vegetation and threatened species habitat.

- Impact to threatened fish distribution and key fish habitat in the Macquarie River and Queen Charlottes Creek will be avoided by underboring rather than trenching.

- Trenching of the smaller waterways has been proposed due to the relative short time span that trenching construction techniques will require through these often ephemeral creeks and waterways (of approximately 1-2 days).

- Karst, caves and rocky areas have been avoided, not only to facilitate construction, but to avoid impacts to threatened species which rely upon this habitat.

- Impacts to the native vegetation to the east of the MPPS pumping station facility No. 3 will be avoided by underboring this part of the pipeline.

- The pipeline corridor has been aligned to avoid recorded populations of host plants (*Bursaria spinosa*) of the Purple Copper Butterfly. Impact to essential breeding habitat for the species has thus been avoided.

- The pipeline alignment has been refined to avoid mature, hollow-bearing trees and therefore impacts to hollow-nesting threatened species. The locations of hollow-bearing trees recorded during the field survey are mapped in Appendix Y (see Appendix 6 of the BDAR).

- Refinement of the pipeline development footprint to an approximate width of 6 m within areas of native vegetation to minimise vegetation clearing.

- With the exception of pumping station facilities where vegetation clearing of all strata is necessary, clearing of vegetation along the pipeline will be limited to the mid and ground layer only where possible.

- Where their placement within native vegetation cannot be avoided, such as at Bathurst Bike Park (pumping station facility No.4), pumping station facilities have been located in areas of previous disturbance and/or containing poor condition vegetation.

- The disturbance area of the pumping station facility No 4 at Bathurst Bike Park has been reduced from 75 x 75 m (0.56 ha) to 50 x 35 m (0.175 ha) to minimise the impact on native vegetation, given the proximity to the two TECs (NSW listed - White Box - Yellow Box - Blakely's Red Gum Woodland EEC and the Commonwealth listed White Box - Yellow Box - Blakely's Red Gum Grassy Woodland CEEC).

- Laydown areas during construction will be in previously disturbed areas to avoid additional short-term impacts.

The residual impacts are considered unavoidable given the length of the pipeline corridor. Implementation of environmental safeguards to manage unavoidable impacts and offsetting impacts are set out in Table 27.4.

27.5 Impact assessment

27.5.1 Direct impacts

The main direct impacts of projects on biodiversity are generally the clearing of native vegetation and loss of species habitat. During operations direct impacts may arise from pipe bursts or leakages which could impact on the habitat in the immediate surrounds.

i Loss of vegetation

Approximately 8.51 ha of native vegetation, comprising of 12 PCTs, will be impacted by construction of the pipeline, with one of these PCTs being a state listed EEC and one being a Commonwealth listed CEEC.

The BC Act listed White Box Yellow Box Blakely's Red Gum Woodland (EEC) comprising an area of 1.17 ha occurs within the pipeline corridor. Clearing at pumping station facility No.4 will permanently remove 0.175 ha of this vegetation type. With about 66.88 ha within the study area, this represents approximately 1.7% of the known EEC within in the study area being directly impacted and 0.3% being permanently cleared.

One EPBC Act listed CEEC, White Box - Yellow Box Blakely's - Red Gum Grassy Woodland and Derived Grassland community, comprising an area of 0.28 ha of moderate condition vegetation occurs within the pipeline corridor at the site of pumping station facility 4. With about 33.3 ha of the CEEC in the study area, this represents a 0.8% removal of the CEEC in the study area.

The EPBC Act significant impact guidelines have been applied to the CEEC using the nine tests set out within the Act. The assessment (see Appendix Y, BDAR section 7.1) found no significant impact on the CEEC.

The assessment has assumed a worst-case estimate, that all areas in the pipeline corridor would be cleared of vegetation. However, where possible during construction, vegetation clearing will be minimised specifically including the retention of mature or hollow-bearing trees native trees.

ii Serious and irreversible impacts (SAII)

The *Guidance to assist a decision-maker to determine a serious and irreversible impact* (the Guide) (NSW Office of Environment and Heritage, 2017) has been used to determine which threatened species require further assessment for serious and irreversible impacts (SAII). One endangered ecological community (being White Box - Yellow Box Blakely's Red Gum Woodland EEC) is listed as a candidate entity for SAII in the Guide and assessment under the BAM. 0.175 ha of the EEC will be permanently cleared at pumping station facility No. 4. The assessment (Appendix Y, section 6.4) concluded that there are no SAII associated with the pipeline development.

iii Threatened species and habitat

a NSW listed species

Six BC Act listed threatened species were recorded during the field survey and 10 BAM species credit species were assumed present based on the absence of targeted survey in suitable habitat or low likelihood of detection based on climatic conditions at the time of the survey. Impact to these species will be offset in accordance with the Biodiversity offset scheme.

b Koala

Results of the survey indicate that the pipeline corridor is not core Koala habitat, but that the area mapped as the above PCT comprises potential Koala habitat. The pipeline development does not require the removal of mature trees that might be important for foraging Koala. Any impact to Koala habitat as a result of the pipeline development has been considered through the calculation of ecosystem credits under the BAM.

c Commonwealth listed species

The EPBC Act significant impact guidelines (*Significant Impact Guidelines 1.1: Matters of National Environmental Significance*) have been applied as set out within the Act against the ten relevant threatened species and one CEEC identified by the Protected Matters Tool which may occur in the pipeline corridor based on presence/presence of habitat elements. The assessment found no significant impact for any of the ten species being: Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), Spotted-tailed Quoll (*Dasyurus maculatus*), Painted Honeyeater (*Grantiella picta*), Koala, Superb Parrot, Grey-headed Flying Fox, Purple Copper Butterfly, Austral Toadflax (*Thesium australe*), and Macquarie Perch, nor any significant impact to the CEEC of White box – Yellow box – Blakely's Red Gum grassy woodland.

The migratory species identified under the EPBC Act are unlikely to be significantly impacted due to the temporary nature of the construction which will progress quickly along the pipeline corridor, with only the pumping station facilities having any extended construction period.

d Threatened fish species

Two threatened fish species are predicted to occur within the study area based on NSW DPI Fisheries predictive mapping, Macquarie Perch and Purple-spotted Gudgeon.

Within the study area, Macquarie Perch is only known from the Macquarie River. This crossing will be underbored, meaning there is no potential impact on this species as a result of the pipeline development. As detailed above, assessment under the EPBC Act indicates no significant impact.

In accordance with the *Fisheries Management Act 1994*, the seven-part test of significance has been undertaken for the Purple-spotted Gudgeon. This found there will be no significant impact to the Purple-spotted Gudgeon as a result of the proposal.

With implementation of appropriate erosion and sediment controls within the creek crossings which will be identified in the CEMP, it is unlikely that there will be any significant impacts to threatened fish species.

e Groundwater dependent ecosystems

The pipeline excavation is shallow (typically 1.5 to 2.0 mbgl) and is unlikely to cause any reduction in groundwater availability and will therefore not impact on GDEs.

iv Indirect impacts

Other minor indirect impacts could include:

- fauna vehicle strike;
- impacts to water quality and quantity due to:
  - sediment runoff and/or contaminant runoff into adjacent watercourses;
  - fuel, chemicals, oils, grease or hydrocarbon spills from construction machinery;
  - spills of concrete during concrete pours directly polluting downstream waterways and soils;
  - contamination from construction compounds, chemical storage areas and wash-down locations;
  - contamination of waterways as a result of disturbance of contaminated land;
  - fragmentation of habitats and associated impacts to connectivity and fauna movement;
  - increased noise, vibration and dust levels;
  - artificial lighting impacting nocturnal species behaviour, particularly during construction, however work hours are intended to be during daylight hours;
  - increase in weeds and pathogens; and
  - from fuel spillages or pipe breakages.

Appropriate management measures to minimise potential indirect impacts will be incorporated into the CEMP for the pipeline development as outlined in Section 27.6.

v Prescribed impacts

The *Biodiversity Conservation Regulation 2017* lists nine impacts as prescribed impacts that must be avoided, minimised and mitigated. Five of those impacts relate to the pipeline development and will require mitigation as considered in Table 27.4 below.

Table 27.4 Relevant prescribed impacts under the Biodiversity Conservation Regulation 2017

Prescribed impact	Assessment
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	Non-native vegetation on the pipeline development may provide habitat for ecosystem credit species.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	Some loss of connectivity may occur as a result of the pipeline development, although due to the narrow width of the corridor, this is likely to be minimal.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.	Runoff carrying sediment from the pipeline development at watercourse crossings.
Impact of vehicle strikes on threatened species of animals or on animals that are part of a TEC.	There will be increased vehicle traffic in the pipeline corridor during the construction phase.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	Non-native vegetation on the development site may provide habitat for ecosystem credit species.

27.5.2 Impacts to Matters of National Environmental Significance

The pipeline development will remove 0.28 ha of one EPBC Act listed White Box Yellow Box Blakely's Red Gum Grassy Woodland CEEC. Two Critically Endangered (CE), one Endangered (E) species and six vulnerable listed under the EPBC Act also have the potential to be impacted by the pipeline development.

Assessments of significance were completed in accordance with the relevant criteria in *EPBC Act significant impact guidelines 1.1: Matters of National Environmental Significance* for the CEEC listed above and EPBC Act listed threatened species. The assessments concluded that the pipeline development would not result in significant impacts on these species.

27.5.3 Impacts to aquatic ecology

One threatened fish listed under the FM Act has the potential to be impacted by the pipeline development, namely the Purple-spotted Gudgeon. Section 220Z of the FM Act requires the 7-part test be completed for this species. This was applied, finding no significant impact.

27.5.4 Impacts requiring offsets

Regis plans to offset the biodiversity impacts of the pipeline development by entry into the NSW Biodiversity Offset Scheme. Some impacts will require offsetting in accordance with the BAM. Impacts of the pipeline development on native vegetation, threatened species and threatened communities has been quantified under the BAM as biodiversity credits, including ecosystem credits for the clearing of native vegetation and species credits for species credit species.

Regis could meet its offset obligations by establishing a biodiversity stewardship site, trading the correct number and types of biodiversity credits or seek to offset the pipeline development by paying into the Biodiversity Conservation Trust. Table 27.5 identifies the credit calculations required to offset the biodiversity impacts of the pipeline development. A discussion on the proposed biodiversity offset strategy to meet these credit requirements, along with the credit requirements for the mine development is provided in Chapter 13.

Table 27.5 Biodiversity credit requirements for the pipeline development

Offset Type	Offset Type	Credits required
Ecosystem credit	River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	1
	Long-leaved Box - Red Box - Red Stringybark mixed open forest on hills and hillslopes in the NSW South Western Slopes Bioregion.	10
	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion.	10
	Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	4
	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	1
	Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	47
	Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	14
	Carex - Juncus sedgeland/wet grassland of the South Eastern Highlands Bioregion	1
	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	38
	Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	1
	Snow Gum - Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion	7
	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	5
Subtotal		**139**
Species Credit	Eastern Pygmy-possum	125
	Southern Myotis	1
	Barking Owl	4
	Powerful Owl	4
	Purple Copper Butterfly, Bathurst Copper Butterfly	6
	Squirrel Glider	78
	Brush-tailed Phascogale	59
	Silky Swainson-pea	8
	Austral Toadflax	4
	Masked Owl	4
Subtotal		**293**
Total		**432**

27.6 Mitigation

The following sections list the safeguards and mitigation measures that have been proposed to address potential impacts on biodiversity. These measures have been developed to mitigate the potential impacts of the proposal on threatened flora and fauna species and any residual impacts that cannot be mitigated would be offset in accordance with the BAM. The mitigation measures will be incorporated into the CEMP for the pipeline development.

Environmental safeguards are proposed for terrestrial lands and to mitigate impacts to aquatic habitats and biodiversity, as outlined in Table 27.6 and 27.7.

Table 27.6 Environmental terrestrial safeguards

Impact	Environmental Safeguard	Timing
Clearing and prevention of over-clearing	• Where possible, the pipeline will be constructed on or adjacent to existing roads and forestry tracks, significantly reducing the extent of vegetation required to be cleared. • All personnel are to be inducted to be aware that disturbance of any stand of native vegetation outside the pipeline corridor, or otherwise unauthorised disturbance, could have legislative consequences if done without approval. Evidence of all personnel receiving an induction would be kept on file (signed induction sheets). • Before start of work, clearly identify the extent of permitted vegetation clearing and areas to be retained as native vegetation. • A pre-clearing process and unexpected threatened species finds procedure is recommended. This would see trees identified with high habitat values to be removed only under supervision of an experienced ecologist or animal handler (e.g. WIRES personnel). Any fauna found during the disturbance are to be allowed (or assisted) to relocate into adjoining habitat. • Vegetation will be removed in such a way to avoid unnecessary damage to surrounding vegetation. • Where possible, vegetation to be removed will be mulched on-site and re-used to stabilise disturbed areas. • Natural regeneration of any bare soil or cleared areas will be encouraged through retention of native vegetation material on site and brush-matting. • Where native vegetation occurs, existing access roads and the pipeline corridor itself will be used to access the construction site where possible.	Pre-construction Construction
Soil management	• Develop and implement and erosion and sediment control plan to manage erosion risks in accordance with Council requirements and/or Landcom's Managing Urban Stormwater, Soils & Construction Guidelines 'The Blue Book' (Landcom, 2004). • Monitor erosion for a 12 month period following construction. Implement corrective action if required. • Easement to be reinstated to natural ground level and allowed to naturally regenerate.	Pre-construction Post construction
Damage to native vegetation outside of impact zone	• Stockpile and compound sites are to be located within the assessed development footprint and preferentially according to the following criteria: – at least 40 m away from the nearest waterway. – in areas of low ecological conservation significance (i.e. previously disturbed land). – on relatively level ground. • Stockpiling of materials and equipment, and parking of vehicles, is to be avoided within the dripline (extent of foliage cover) of any tree.	Construction

Table 27.6 Environmental terrestrial safeguards

Impact	Environmental Safeguard	Timing
Introduction and spread of significant weeds and pathogens	• Inspection and control of environmental weeds in accordance with a site vegetation management plan and subject to requirements of Council. • Construction machinery and vehicles will be clean, and soil- and weed-free, before entry to the work site. • Any new fill brought onto the pipeline corridor will be certified, weed-free fill only to be used for on-site earthwork. • Any herbicide use is to be in accordance with the requirements on the label. Any person carrying out herbicide application would be appropriately trained and competent in its use. • Monitor weeds at pump stations annually during operational stage. Implement control when necessary.	Construction Post Construction Operation
Disturbance to fallen timber, dead wood and bush rock	• Woody debris, dead wood and bush rock encountered on site is to be relocated to the edge of the disturbance area to enhance habitat and regeneration. • Where practical, it will be re-spread on easement at completion.	Pre-construction Construction
Threatened species	• Immediately prior to construction, a qualified ecologist will be engaged to undertake targeted survey for Aromatic Peppercress, Capertee Stringybark, Silky Swainson-pea and Austral Toadflax. • The location of any of the above plants recorded will be clearly marked, and the pipeline constructed so as to avoid individuals/populations where practical. Where unavoidable, impact will be offset in accordance with the BAM. • Hollow-bearing trees will be clearly marked pre-construction and retained. • No new tracks to be cleared without further assessment, as threatened flora species may occur in any unassessed impact area. • If the impact footprint changes from the current extent assessed in the study, re-assessment of the potential impact of the activity would be needed to ensure impacts to threatened species are not inadvertently caused, given that suitable habitat for threatened species occurs elsewhere on the property. • Construction work to occur only during daylight hours where practical to avoid indirect impacts on threatened fauna such as vehicle strikes. • Enforce 20 km/h speed limits off road to reduce the risk of vehicle strikes. Sign posted speed limits will be enforced on public access roads. • Monitor natural regeneration annually for 24 months following construction. Implement corrective action if required. • Where the pipeline easement traverses White Box Yellow Box Blakely's Red Gum Woodland EEC, revegetation of the easement will be assisted post-construction by the spreading of native grass seed, using a mix of species listed in the BioNet Vegetation Classification descriptions for the relevant PCTs.	Construction Post-construction

Table 27.7 Environmental safeguards for mitigation of impacts to aquatic habitat and biodiversity

Impact	Environmental Safeguard	Timing
Loss and degradation of riparian and aquatic habitat	• select locations and construction methods for pipeline crossings that minimise disturbance of the riparian zone. Existing cleared or disturbed areas adjacent to easements such as roads, existing crossing points will be used; • locate under bore entry and exit points outside designated riparian corridors and existing vegetation; • revegetate disturbed areas with local native species immediately after construction works are completed and monitor rehabilitated areas to ensure that revegetation is successful; • use flow diversion methods for trenching construction as required; • avoid the removal of large woody debris situated instream; • select an appropriate boring depth below the watercourse for under bored crossings to prevent bed collapse; • when trenching, impacts on flows will be reduced by staging the trench across the channel or minimising the time that flows are stopped or intercepted; and • once the pipeline is laid, scouring and erosion will be prevented by restoring the channel shape and bed level to its preconstruction condition by backfilling the trench with appropriate material.	Pre-construction Construction Post-construction
Contamination from accidental spillages of fuel and oil	• minimise direct access to the river by construction vehicles and machinery; • inspect construction vehicles and machinery for leakage of fuel and oils; • establish a bunded area for storage of fuel and oils and refuelling of machinery. Vehicles will not be refuelled on site; and • report spillages to the appropriate officer and immediately deploy spill containment kits to restrict their spread to or within the river.	Construction
Increased sediment load and turbidity Addition of organic matter Addition of nutrients	Include the following in the sediment and erosion control plan: • restriction of vegetation clearing and construction works to no rainfall periods to reduce the risk of sediment runoff; • deployment of erosion control matting in the riparian zone and silt curtains along the river bank to prevent sediment entering the river channel and provision of protection against scouring and erosion of the river bed; • inspect these control measures regularly during the course of construction to ensure they are functioning properly; • installation of a coffer dam made of appropriate materials to isolate the construction site and minimise downstream impacts; • monitor turbidity, pH and oxygen levels of the water within and downstream of the construction area and, if a decline in water quality is detected, stop or scale back further works and revise control measures; • stabilisation and rehabilitation of disturbed/eroded areas of the river bed and bank, riparian zone and instream aquatic habitat; • minimise the time open cut trenches remain open; and • stockpile the material removed from the trench outside the riparian zone to prevent runoff into the watercourse during rainfall events.	Pre-construction Construction Post-construction
Disruption of movement of fish	• Limit construction to periods of low water flow or during critical fish migration and spawning seasons (ie Spring and Summer).	Construction
Injury or mortality of aquatic biota contained within coffer dams	• Translocate fish, turtles and platypi from the coffer dam to flowing water within the river. Screen the pump to minimise entrainment of fish when the water is pumped out.	Construction

27.7 Conclusion

The key findings of the BDAR for the pipeline development are as follows:

- a total of 12 PCTs were identified as occurring within the pipeline corridor, totalling 8.5 ha in extent. Vegetation condition ranges from poor to good, with several PCT occurring in three condition states;
- one BC Act listed threatened ecological community was identified within the corridor: White Box Yellow Box Blakely's Red Gum Woodland EEC;
- one EPBC Act listed threatened ecological community was identified within the corridor: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Grassland community CEEC;
- six threatened BC Act listed species were recorded during the field survey. For the purposes of assessment under the BAM, they are all ecosystem species;
- ten BAM species credit species were assumed present based on the absence of targeted survey in suitable habitat or low likelihood of detection based on climatic conditions at the time of the survey;
- to offset the impact of the pipeline development on native vegetation and threatened species, Regis is required to enter the Biodiversity Offset Scheme. A total of 139 ecosystem and 293 species credits are required;
- one threatened fish species – Purple-spotted Gudgeon – could be impacted by the development. The FM Act seven-part test of significance for this species indicates that there will be no significant impact as a result of the pipeline development; and
- EPBC Act significant impact guidelines were applied to one EPBC listed CEEC and ten EPBC listed threatened species. The pipeline development will not have a significant impact on any of these species or community.

Chapter 28

Aboriginal heritage

REGIS RESOURCES LTD

28 Aboriginal heritage

28.1 Introduction

An Aboriginal Cultural Heritage and Historic Heritage Assessment (AHCHA) for the pipeline development was prepared by OzArk (2019b) and is contained in Appendix Z. This chapter provides a summary of the AHCHA as it relates to Aboriginal cultural heritage. This chapter discusses the historical context in and surrounding the pipeline corridor, describes the consultation undertaken with the Aboriginal community, outlines fieldwork methods and items identified in the pipeline corridor, and assesses the potential impacts of the pipeline development on Aboriginal cultural heritage values and where impacts are unavoidable, the measures proposed to mitigate impacts.

The EARs require Aboriginal cultural and archaeological heritage from the construction and operation of the pipeline development to be assessed in accordance to the relevant requirements detailed in Table 28.1.

Table 28.1 Aboriginal cultural and archaeological heritage related EARs for the pipeline development

Requirements	Where addressed
An assessment of the likely Aboriginal (cultural and archaeological) impacts of the development, including adequate consultation with Aboriginal stakeholders having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH, 2010)*	This Chapter Appendix Z

The ACHA was guided by the following guidelines to fulfil the requirements of the EARs:

- *Guide to Investigation, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a); and
- *Aboriginal Cultural Heritage Community Consultation Requirements for Proponents 2010* (DECCW 2010b).

28.2 Existing environment

Gentle to moderate slopes or moderate to steep slopes with flat areas associated with watercourses or tops of slopes, dominate the topography of the pipeline corridor. The majority of the pipeline corridor is within the South Eastern Highlands bioregion which is largely comprised of the plateau and dissected ranges of the Great Dividing Range.

A search of the AHIMS database returned 89 records for Aboriginal heritage sites within the designated 1.5 km search area around the pipeline corridor. Only three of these were anticipated to be within the corridor, as discussed further in Section 28.5.1.

28.3 Aboriginal consultation

The Aboriginal cultural and archaeological heritage assessment follows the guidelines set by the *Aboriginal Cultural Heritage Consultation Requirements for Proponents (*ACHAR) (OEH 2010) and includes the four main stages set out below.

28.3.1 Stage 1 – notification and registration of Aboriginal parties

Stage 1 involves the identification of Registered Aboriginal Parties (RAPs) who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and/or places in the area of the pipeline development. RAPs were notified through expression of interest advertisements and letters forwarded by Navin Officer Heritage Consultants Pty Ltd. A consultation log contained in Appendix 1 of the ACHAR documents each organisation, type of communication and the mode of contact. Aboriginal parties which registered their interest in the pipeline development are listed in Table 28.2.

Table 28.2 List of Registered Aboriginal parties (RAPs) for the pipeline development

Registered Aboriginal Party name	Date registered as RAP
Bathurst LALC	19/09/2017
Gundungurra AHA Inc	26/09/2017
Dhuuluu-Yala Enterprises	27/09/2017
Gundungurra TC	27/09/2017
Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC)	28/09/2017
Wiradyuri Traditional Owners Central West Aboriginal Corporation	28/09/2017
Neville and Region Landcare	28/09/2017
Gunjeewong	28/09/2017
Murgadi	28/09/2017
Murra Bidgee	28/09/2017
Warrabinga	13/10/2017
Orange LALC	20/06/2018

28.3.2 Stages 2 and 3 presentation of information and gathering cultural information

Stage 2 is structured to provide information about the proposal to the RAPs and their representatives. Stage 3 involves the gathering of information about Aboriginal cultural and archaeological heritage through field work or consultation.

On 4 June 2018, all RAPs were sent the pipeline development overview and survey methodology for feedback within a 28 day period. Feedback was provided by the Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC) regarding the survey methodology.

On 15 June 2018 Regis held an Aboriginal Focus Group Meeting and field work induction at the Regis office in Blayney to outline the pipeline development and provide the RAPs the opportunity to pass on specific cultural information relating to the study area. The minutes of this meeting are included in Appendix 1 of the ACHAR (refer Appendix Z).

28.3.3 Stage 4 – review of draft Aboriginal Cultural Heritage Assessment

The draft ACHAR was sent to all RAPs for review and comment over a 28 day period. The comments received from RAPs are summarised as follows:

- three of the RAPs were supportive of the ACHA, the pipeline route and minor adjustments to the pipeline alignment to follow a greater amount of existing roadway and tracks;

- the Wellington Valley Wiradjuri Aboriginal Corporation recommended management measures to minimise harm to any artefacts directly impacted or close to the pipeline corridor; and
- the Orange LALC raised a number of concerns predominately concerned with the mine development of the project which have been addressed in the AHCHA for the mine development (refer Appendix P). Relevant issues for the pipeline development have been addressed in OzArk (2019) (Appendix Z).

28.4 Fieldwork methods

28.4.1 Predictive model of Aboriginal site location

A predictive model of Aboriginal site location was developed by OzArk (2019b) which considered the environmental and archaeological context of the pipeline corridor. Based on the knowledge of the environmental contexts of the study area and a desktop review of the known local and regional archaeological record, the most likely site types within the pipeline corridor are artefact scatters and isolated artefacts.

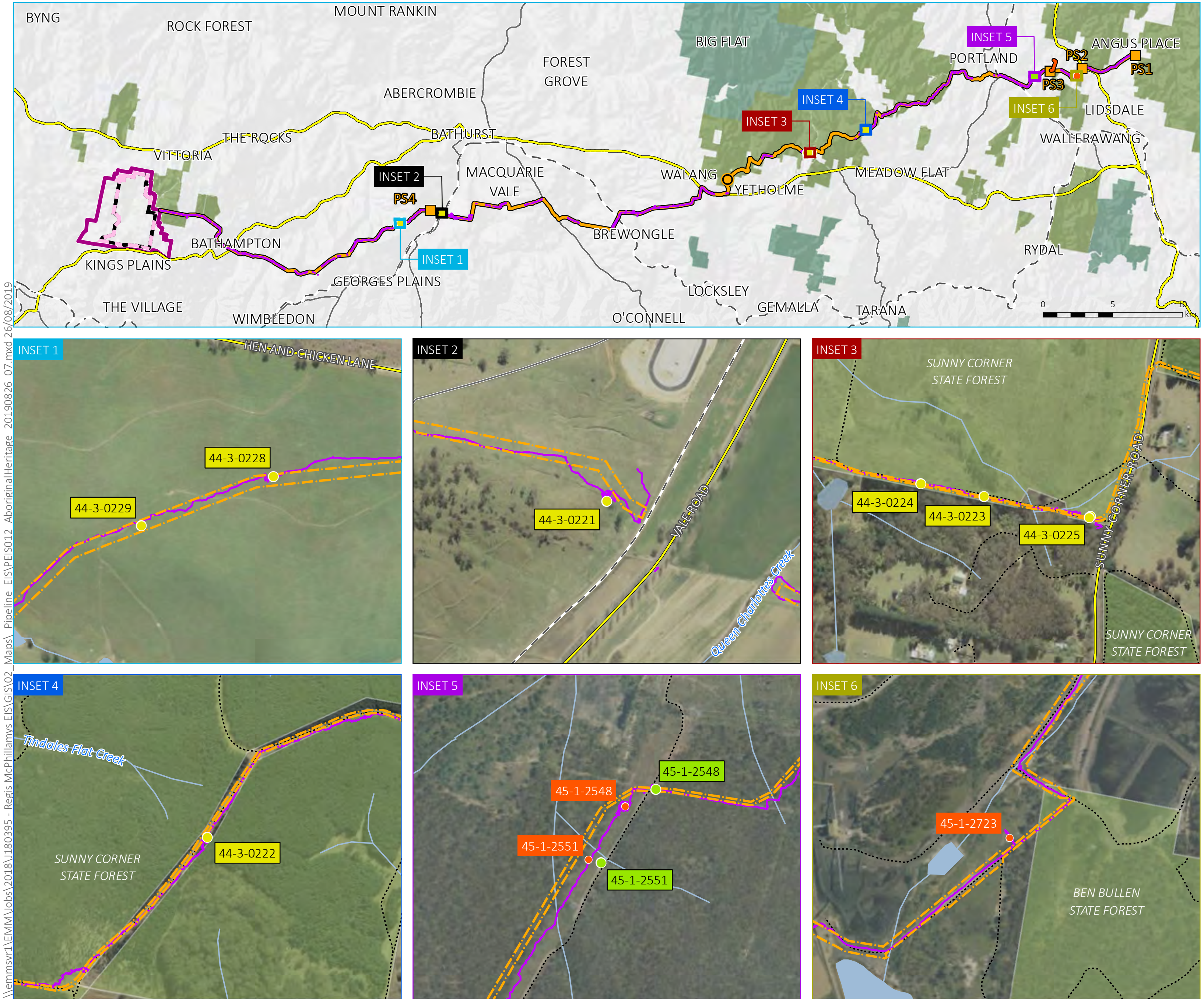
A summary of the predictive model is as follows:

- **Isolated finds** - can occur anywhere, particularly within disturbed contexts, it was predicted that this site type could be recorded within the study area;
- **Open artefact scatters -** as the study area traverses a wide range of landforms, this site type was predicted to potentially occur. Artefact scatters are most likely to be located within landforms of a gentle gradient associated with permanent / semi-permanent waterways as these are likely to have been attractive camping areas;
- **Aboriginal scarred trees** – as much of the study area has been previously cleared, this site type was predicted to be very rare. OzArk (2019b) also noted that this site type is very rare at a regional level;
- **Quarry sites and stone procurement sites** – OzArk found that this site type could be recorded within the study area should suitable rock outcroppings be available; and
- **Burials –** although possible that this site type could be found within the study area, OzArk considered burials a rare site type especially given the disturbance that has occurred within the study area.

28.4.2 Archaeological survey

Fieldwork was conducted as a pedestrian survey whereby targeted sections were surveyed by traversing the pipeline corridor by foot. Highly disturbed portions of the alignment (roads and unsealed tracks) were traversed by vehicle.

Representatives from the RAPs were present during the surveys. Where areas were unable to be surveyed in the field due to no access being provided by landholders, a desktop assessment was relied upon. Field assessment of pipeline corridor from the MPPS blowdown pond to pumping station facility 3 at MPPS was not undertaken, as this area was extensively surveyed for the EIS for the Springvale Water Treatment Project (EA 2016). The assessment for this area was undertaken as a desktop review of the EIS and other information. Figure 28.1 illustrates the pedestrian survey coverage of the survey.



KEY

- Pedestrian survey
- Aboriginal sites/artefacts
  - Aboriginal sites/artefacts recorded during the survey
  - AHIMS site (registered location)
  - Likely location of AHIMS site
- Project application area
  - Mine development project area (2,513.47 ha)
  - Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
  - Pressure reducing system
  - Pumping station facility
  - Pipeline corridor
  - Pipeline corridor (refer to insets)
  - Pipeline corridor (Blowdown Pond)
- Existing environment
  - Rail line
  - Primary road (overview) Main road (inset)
  - Arterial road (overview) Local road (inset)
  - Vehicular track (inset)
  - NPWS reserve
  - State forest

Source: EMM (2019); Regis Resources (2019); OzArk (2019); DFSI (2017); GA (2011)

Aboriginal sites recorded during the survey - pipeline development

McPhillamys Gold Project
Environmental impact statement
Figure 28.1

REGIS RESOURCES LTD EMM creating opportunities

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OzArk (2019b) notes that the highest ground visibility was along unsealed roads, while the lowest was within the sealed road reserves. The amount of visible ground (outside roads or tracks) was highest within the moderate to steep slopes and ridges as these were generally cleared with less ground cover than the flat landforms. Visibility within the creek flats was hampered by leaf litter and dense grasses. The most archaeologically sensitive areas along the banks of waterways were the second lowest for survey efficacy due to the effects of gully erosion, trampling and earthworks.

28.5 Field survey results

28.5.1 Previously recorded Aboriginal cultural heritage sites

Three previously recorded AHIMS sites were predicted to be located within or adjacent to the pipeline corridor; however, only one of these sites was found during fieldwork. Searches for previously recorded AHIMS Aboriginal sites carried out during the field survey are summarised as follows:

- Two previously recorded sites are outside of the pipeline corridor (AHIMS #41-1-2723 and #45-1-2551). Of these two sites, only #41-1-2723 was able to be located.
- One previously recorded site is located inside the pipeline corridor (AHIMS #45-1-2548) and was unable to be located.

28.5.2 Aboriginal cultural heritage sites recorded

Six previously unidentified Aboriginal cultural heritage sites were recorded within the pipeline corridor during the field survey comprising:

- 5 isolated artefacts; and
- 1 artefact scatter (2 artefacts).

In addition, 1 isolated artefact was identified immediately adjacent to the pipeline corridor. The sites recorded during the survey are illustrated in Figure 28.1.

The results of the survey indicated that general site integrity was low. All sites were recorded in a secondary context as all have been disturbed by various types of impacts and OzArk (2019) concluded there was little likelihood of any intact subsurface deposits being associated with the sites.

28.6 Significance assessment

Each of the seven recorded sites were assessed for significance. The assessment of significance is based on the baseline elements of social or cultural, archaeological/scientific, aesthetic and historical value. The combination of these elements determines the overall cultural heritage values of a site and subsequently inform the appropriate management strategy.

28.6.1 Social and cultural value

Social and cultural values are assessed against the importance of a site and its features to the relevant Aboriginal community. The assessment of sites, items and landscapes that are traditionally significant to the Aboriginal community informs the social and cultural significance of the area. The Aboriginal community are concerned with the traditional links with specific areas and the continued protection of the sites. It is noted that archaeologists may interpret a site as having low archaeological value, but Aboriginal groups regard a site as having high social and cultural values.

The results of the field survey were sent to the RAPs for further comment and additional cultural values were added to the ACHAR. The feedback provided by RAPs is that high cultural values are placed on all artefacts regardless of whether the site is an isolated find or a rock shelter with art and archaeological deposits. Accordingly, the social and cultural value is assessed as high.

28.6.2 Archaeological/scientific value

Archaeological or scientific values are assessed against the broader regional context and each site's individual merits. Archaeological values inform the management strategy to preserve a representative sample of the artefacts within the pipeline corridor. The ability of sites to contribute to current research and future research potential also adds to the archaeological or scientific values. Sites that have archaeological significance are used as comparisons to evaluate the representativeness of other sites in a region.

All recorded sites were assessed as of low scientific significance with little or no research potential or ability to inform researchers about the nature and extent of Aboriginal occupation in the area. This was based on the following values:

- sites represent artefacts in secondary contexts;
- low density of artefacts;
- no formal tool types;
- no associated archaeological deposits; and
- widespread past and current disturbance through either ploughing practices or use of existing unsealed roads or tracks.

28.6.3 Aesthetic value

Aesthetic values refer to the sensory, scenic, architectural and creative aspects of a place, which are closely linked with social values. Australia ICOMOS 2013 notes that aesthetic values are informed by form, scale, colour, texture, material of the landscape, and smell and sounds associated with the place.

All recorded sites were assessed to be of low aesthetic value as the integrity of the sensory landscape has been altered in historic and modern times. OzArk (2019b) found the identified artefacts generally to be not remarkable.

28.6.4 Historic value

Historic value refers to the associations of a place with a historically important person, event, phase or activity in an Aboriginal community. All recorded sites were assessed as having no historic value. There is no apparent direct relationship to known historical Aboriginal sites, nor to contact or post-contact Aboriginal sites.

28.7 Impact assessment

Six sites identified during the field survey and one previously recorded site are within the pipeline corridor (although this site AHIMS #45-1-2548, was unable to be located during the survey). These sites are therefore likely to be subject to direct disturbance as a result of construction activities including trenching works to install the pipeline, excavation of underbore pits and construction of ancillary infrastructure such as the pumping station facilities. The Aboriginal sites within the pipeline corridor and therefore subject to direct disturbance are identified on Figure28.1.

The digging and trenching of the pipeline development may uncover artefacts, although the probability is low due to the survey results indicating low density artefact scatter.

The likely impacts to the identified Aboriginal heritage within and in the immediate vicinity of the pipeline corridor are set out in Table 28.3.

Table 28.3 Aboriginal cultural heritage impact assessment – pipeline development

Site name	Site number	Type of harm (direct/indirect/none)	Degree of harm (total/partial/none)	Consequence of harm (total/partial/no loss of value)
Sites within pipeline corridor				
Sunny Corner IF-1	44-3-0222	Direct	Total	Total
Sunny Corner IF-2	44-3-0223	Direct	Total	Total
Sunny Corner IF-3	44-3-0224	Direct	Total	Total
Sunny Corner OS-1	44-3-0225	Direct	Total	Total
IV-IF-2	45-1-2548	Direct	Total	Total
Bald Hill IF-1	44-3-0229	Direct	Total	Total
Bald Hill IF-2	44-3-0228	Direct	Total	Total
Sites outside pipeline corridor				
CS SU4-A2	45-1-2723	None	None	No loss of value
Bathurst Bike Park IF-1	44-3-0221	None	None	No loss of value
IV-OS-5	45-1-2551	None	None	No loss of value

28.8 Management measures

Impacts on Aboriginal heritage will be managed through an Aboriginal Cultural Heritage Management Plan (ACHMP), which will be developed in consultation with RAPs and DPIE – Biodiversity and Conservation Division. The following general mitigation and management measures will be included in the ACHMP:

- the seven sites (AHIMS #44-3-0222, #44-3-0223, #44-3-0224, #44-3-0225, #44-3-0228, #44-3-0229 and #45-1-2548) which will be directly impacted will be salvaged through the recording and collection of surface artefacts;
- salvaging, including the recording and collection of the surface artefacts, will be done in consultation with the RAPs;
- temporary barriers will be erected and maintained using high visibility ground markers around the three sites identified adjacent to but outside of the corridor prior and during construction works to prevent inadvertent disturbance. It is noted this is unnecessary for CS SU4-A2 (45-1-2723) as the site is already permanently fenced; and
- an unanticipated discovery protocol for any previously unidentified items/areas of potential Aboriginal archaeological significance, including skeletal remains, identified during construction.

Following construction and depending on RAP consultation, the artefacts will either be kept in safe keeping, returned to where they were salvaged from, or relocated to a safe location which will not be impacted by ongoing maintenance following the construction of the pipeline.

28.9 Conclusion

The ACHAR identified seven Aboriginal heritage sites within the pipeline corridor. All sites within the corridor will be salvaged prior to disturbance in the area.

OzArk (2019b) has assessed the archaeological/scientific, aesthetic and historical value as low. Based on feedback from the RAPs, the social or cultural value of all sites has been assessed as high.

An ACHMP will be prepared to guide the management of sites in the pipeline corridor and avoid inadvertent impacts on sites located outside of the corridor. The ACHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains.

Chapter 29

Historic heritage

29 Historic heritage

29.1 Introduction

This chapter includes a summary of the results of the historic (non-Aboriginal) heritage component of the Aboriginal Cultural Heritage and Historic Heritage Assessment Report (ACHAR) undertaken for the pipeline development by OzArk (2019b) (Appendix Z). The report describes the historical context in and surrounding the pipeline corridor, describes heritage listed items within the study area and assesses the potential impact of the pipeline development on historic heritage.

The EARs require the likely historic heritage impacts of the construction and operation of the pipeline development to be assessed in accordance with the *NSW Heritage Manual*. Historic heritage related EARs are detailed in Table 29.1. below.

Table 29.1 Historic heritage related EARs

Requirement	Where addressed
An assessment of the likely historic heritage (cultural and archaeological) impacts of the development	Section 29.4
An assessment of the impact on environmental heritage in accordance with the *NSW Heritage Manual*, including heritage conservation areas and State and local heritage items within and near the site, and detailed mitigation measures to offset potential impacts on Heritage values	Section 29.4 and 29.5 ACHAR section 12-13 (Appendix Z)

29.2 Methodology

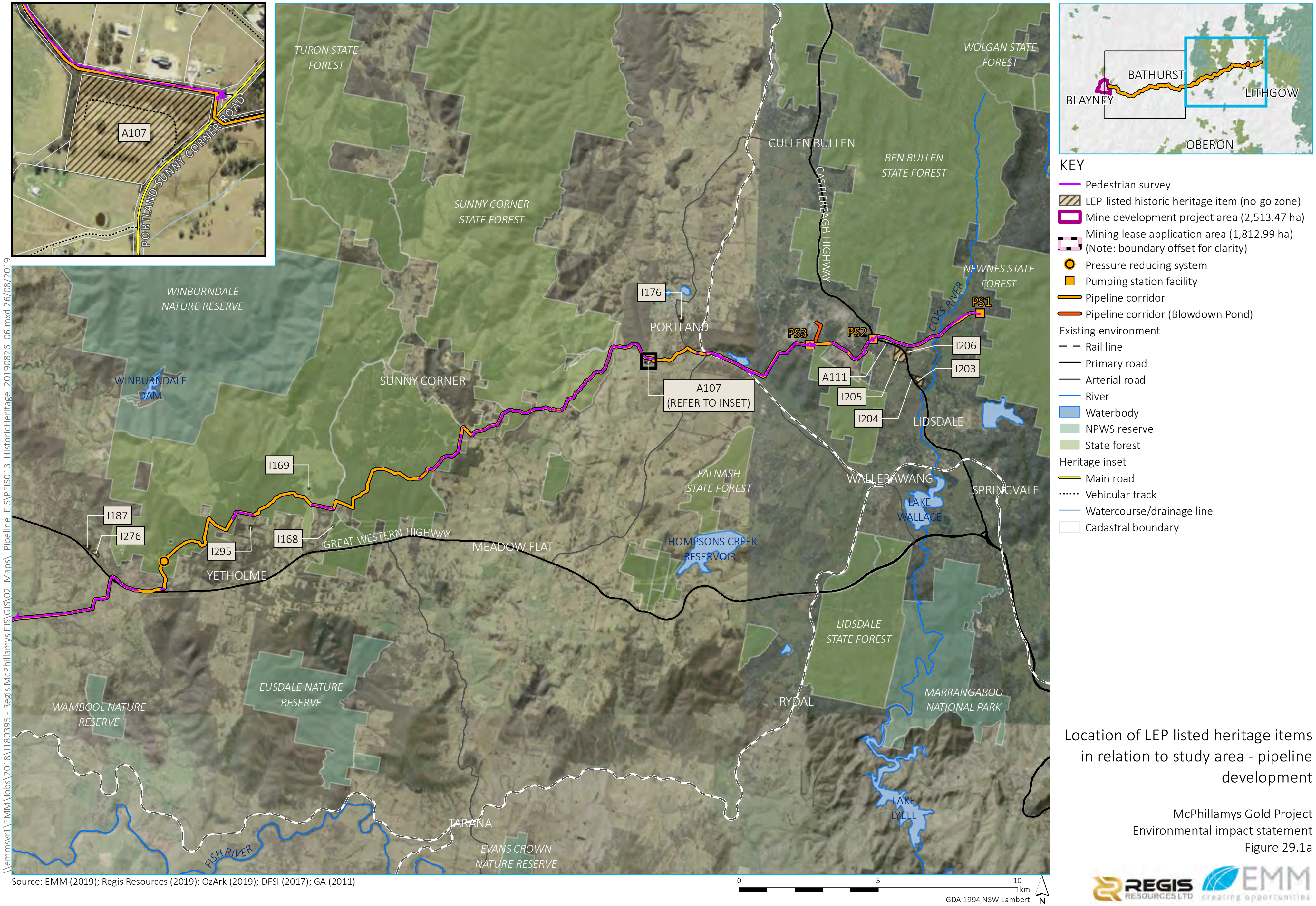
The historic heritage assessment involved a desktop database search and field work. Field work was conducted as a pedestrian survey, whereby targeted sections were surveyed by traversing the pipeline corridor by foot. Figure 29.1 illustrates the surveyed areas for the historic heritage assessment.

29.3 Existing environment

29.3.1 Historical context

Gregory Blaxland, William Wentworth and William Lawson were the first Europeans to cross the Blue Mountains in May 1813. The identification of a way over the mountains which had restricted expansion of Sydney Town and the discovery of agriculturally suitable well-watered plains of the Central Tablelands and fertile valley of the Cudgegong River, resulted in the western spread of Non-Aboriginal settlement. Initially government-controlled, settlement of the region established agriculture and pastoralism (horse, cattle and sheep), often supported by convict labour as the mainstays of the early regional economy. Between 1813 and 1815 exploration of the area around Orange and Bathurst, and further west to the Lachlan and the Wellington Valley continued under the explorers Evans and Oxley.

During the mid-to-late 1800s pastoralism and agriculture were mainstays of the regional economy. Although pastoralism gradually become more dominant, other activities; mining, manufacturing, forestry, industry and other commercial enterprises gradually become more prevalent.



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Source: EMM (2019); Regis Resources (2019); OzArk (2019); DFSI (2017); GA (2011)

Location of LEP listed heritage items in relation to study area - pipeline development

McPhillamys Gold Project
Environmental impact statement
Figure 29.1a

Early European settlement resulted in the construction of historically significant structures such as homesteads, Victorian houses, settler's cottages, country houses, inns, cemeteries and churches. The historic buildings and townscapes of the region are reminder of pastoral and mining activities of the first European explorers and settlers.

i Historical development of the Lithgow area

Lithgow was named in honour of William Lithgow with the first European settlers arriving to the area in 1824. Between 1824 and 1868 settlement in the area was slow. However, in 1868, the construction of the railway line through the Lithgow Valley spread workmen and work camps throughout the region. This prompted development of the earliest commercial coal mines to support the construction camps with coal for heating and cooking. The Hermitage Colliery, the first commercial mine was opened in the same year the railway construction commenced and this was quickly followed by establishment of a number of other commercially operated mines.

The nature of coal as a low value, high volume resource necessitated its need to be delivered in bulk or to be located near established transport infrastructure. The construction of the railway line allowed exportation of coal to became commercially viable, and the development of railways throughout the region facilitated the commercial viability and spread of coal mining in the area.

In 1870, the railway reached Wallerawang and the exploitation of coal reserves began in Wallerawang around 1873. Completion of the Wallerawang-Mudgee railway branch line in 1880s coincided with the rapid growth of the coal mining industry in the Western Coalfields, and coal mines such as the Ivanhoe Colliery followed the railway line. By 1911, Lithgow had a population of 8,196 people serviced by nine hotels, three banks, water infrastructure and gaslights.

ii Historical development of the Bathurst and Blayney areas

Bathurst is the oldest inland settlement in Australia, proclaimed by Governor Macquarie in 1815. Governor Macquarie commissioned William Cox to build a road from Emu Plains to Bathurst Plains, which was completed in 1815. In 1818 small land grants were approved for agricultural development. Between 1822 and 1825 more than 1,000 convicts were deployed to Bathurst, three-quarters of whom were assigned to private pastoralists, and the remainder to public work (Roberts 2014: 247).

By 1826 the government settlement had become a diverse and extensive agricultural enterprise, but due to the poor profitability of this enterprise, Governor Darling instructed the Bathurst government settlement to cease operating as a government farm. Bathurst's economy grew due to the discovery of gold in 1851, and after the gold rush it became a centre for coal mining and manufacturing. The main western railway line from Sydney reached Bathurst in 1876 and the town became an important railway centre.

Pastoralism and agriculture, dominated by squatters employing convict labour, was the economic mainstay of the Blayney region throughout the 1830s and 1840s. In contrast with other nearby towns, the development of Blayney was sporadic; although houses, a mill and an inn were present in 1837 in the area which is today the town, it was not until 1843 that a village was established.

The discovery of gold in 1851 contributed to the growth of Blayney as a mining settlement and the sale of lime from Blayney commenced in 1850. By the 1880s the railway was established, and lime kilns were expanded. During the twentieth century, Blayney's agriculture was supplemented by a butter factory in 1900 and abattoir in 1957.

29.3.2 Listed heritage items

Desktop searches of heritage databases identified 20 locally listed heritage items within 1 km of the pipeline corridor as set out in Table 29.2 and Figure 29.1. None of these listed items are within the pipeline corridor, however two of these items are directly adjacent to the pipeline corridor being:

- Leeholme Homestead and outbuildings listed on the Bathurst Regional LEP 2014; and
- Portland General Cemetery listed on the Lithgow LEP 2014.

Leeholme Homestead and outbuildings, at 3664 O'Connell Road and 47 Tarana Road, Brewongle, is immediately adjacent to the east of the pipeline corridor along O'Connell Road. The site contains a number of substantial buildings: the main house originally designed by architect Gell, and two large stables and carriage buildings plus smaller structures at rear. The majority of the major buildings are brickwork English bond. The house was built in 1872.

Portland General Cemetery at Sunny Corner Road, Portland is immediately adjacent to the south of the pipeline corridor along Reservoir Road and Portland Sunny Corner Rd. The cemetery has the earliest markers being dated back to 1909. The memorials are mostly marble and granite. The cemetery is divided into denominational portions, all signposted but without any row markers. They comprise Anglican, Catholic, Presbyterian and Uniting portions as well as a small general section containing only two marked graves.

The pipeline corridor does not extend over the curtilage of either of these historic heritage items.

There are no Commonwealth, national or NSW state listed heritage items within 1 km of the pipeline corridor.

No additional historical heritage items were located during the field survey within or adjacent to the pipeline corridor.

Table 29.2 Historic listings within 1 km of the pipeline corridor

Name of database searched	Type of search	Comment
Local environmental plan	Blayney Shire Council LEP 2012	1 item within 1 km of pipeline corridor.
	Bathurst Regional LEP 2014	13 items within 1 km of pipeline corridor.
	Lithgow LEP 2014	6 items within 1 km of pipeline corridor.

29.4 Potential impacts

The pipeline corridor route avoids existing structures, including any heritage listed items such as those remaining outside the curtilages of Leeholme Homestead and outbuildings, and the Portland General Cemetery adjacent to the pipeline corridor.

The historical heritage assessment for the pipeline development concluded no historic heritage items will be directly impacted by the pipeline development. The pipeline corridor does not intersect the curtilages of the heritage listed items of Leeholme Homestead and outbuildings or Portland General Cemetery and there will be no ground disturbance impacts outside of the pipeline corridor. However, there is the potential for these items to be indirectly impacted during construction without the implementation of appropriate management measures as identified in Section 29.5.

No visual impacts will occur on heritage items. The pipeline will be buried, except for the pumping station facilities and the pressure reducing system. The above ground structures of the pipeline development will not be within the visual curtilage of any listed heritage items.

29.5 Mitigation, management and monitoring

Impacts on historic heritage will be managed through the CEMP. The CEMP will include the following historic heritage management measures:

- Leeholme Homestead and outbuildings and the Portland General Cemetery will be signposted as 'no go zones' in the construction management plans and all contractors will be made aware to avoid the two sites. 'No go' zones for these two items are shown in Appendix Z.
- to avoid the potential for harm to historic objects on unassessed adjacent landforms, all ground surface disturbing activities will be confined to the pipeline corridor; and
- an unanticipated finds protocol will be developed to manage potential unanticipated historic heritage finds during construction works.

29.6 Conclusion

No historic heritage items will be directly impacted by the pipeline development. The CEMP will include measures to ensure impacts to historic heritage items are avoided as a result of the pipeline construction.


Chapter 30

Traffic and transport



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30 Traffic and transport

30.1 Introduction

An assessment was undertaken to assess potential traffic and transport impacts associated with the pipeline development on the existing traffic and transport conditions (Ason Group 2019). This chapter summarises the traffic impact assessment with the full technical report contained in Appendix BB.

The EARs require the traffic and transport conditions during construction and operation of the pipeline development be assessed in accordance with the requirements in Table 30.1.

Table 30.1 Traffic and transport related EARs for the pipeline development

Requirements	Where addressed
an assessment of the likely traffic and transport impacts of the development on the capacity, condition, safety and efficiency of the road network and any cumulative impacts of other developments in the locality;	Section 30.3 and section 5 and 7 of the Ason Group Traffic impact Assessment report in Appendix BB.
an assessment of the site access routes (including Mid Western Highway and Great Western Highway) and site access points in accordance with the *Roads Act 1993*; and	Section 4.2 and 5.2 of the Ason Group Traffic impact Assessment report in Appendix BB.
a description of the measures that would be implemented to mitigate and / or manage potential traffic impacts including a schedule of all required road upgrades, road maintenance contributions, management of oversized and over mass traffic and other traffic control measures, developed in consultation with the relevant road authority (if required).	Section 30.4, and Section 7 of the Ason Group Traffic impact Assessment report in Appendix BB.

Areas of study for the pipeline development traffic and transport assessment included land parcels and transport infrastructure traversed by the pipeline corridor. Traffic volume, capacity, access and safety of the existing road network were considered in light of the likely traffic and transport impacts of the pipeline development.

30.2 Existing environment

30.2.1 Overview of existing road network

The regional road network is described in Section 3 of Appendix BB and summarised in Table 30.2.

Table 30.2 Roads affected by the pipeline corridor

Road	Location	Sealed / Unsealed	Number of lanes and traffic direction	Width	Posted speed limit (km/h)
Wolgan Road	Local collector road west of Angus Place near PS1 from Castlereagh Highway to Newnes State forest	Sealed	Two lane, two way	10 m	80
Castlereagh Highway	State Highway 18 connecting Great Western Highway to Mudgee and Gulgong to north west NSW	Sealed	Two lane, two way with separated intersections	12 m	100
SCSO and MPPS	Private roads between Castlereagh Highway and Pipers Flat Road	Sealed and unsealed	Single lane, and two lane		private
Pipers Flat Road	Local collector road between Portland and Wallerawang	Sealed	Two lane, two way	6 m	100
John Mackey Drive	Minor road between Pipers Flat Road and Portland Sunny Corner Road	Sealed	Single lane, two-way	6 m + verge 5 m	50
Portland Sunny Corner Road	Local collector between Portland (north) and Sunny Corner Road (south) to the Great Western Highway	Sealed	Two lane, two way	12.5 including verge	50
Reservoir Road	Minor access road between Portland Sunny Corner Road and Bourkes Road in the Sunny Corner State Forest	East: sealed (single width)	East: single, two-way	East: 4.8 m +1 m verge	50
		West: unsealed	West: single lane, two way	West: 4.5 m + 1 m verge	60
Straits Boundary Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	3 m + verge up to 10 m	60
Bourkes Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	3 m + verge up to 10 m	60
Sugarloaf Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	5m + verge up to 10.1 m	60
Sunny Corner Road	Runs north from Great Western Highway into Sunny Corner State Forest to Meadow Flat	Sealed	Single lane, two-way	7.3-8.5 m + verges >12m	60 in State Forest. Elsewhere 100km/h
Kelly Boundary Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	5m + verge up to 10.5 m	60
Egan Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	4.5 m + verge up to 24 m	60
Ridge Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	7.6 m + verge up to 9 m	60
Sunny Corner Road	Local Road running north from Great Western Highway at Kirkconnell into Sunny Corner State Forest	Sealed	Single lane, two-way	10.2 m + up to 6 m verge	60 in State Forest. 100km/h out of the state forest
Kirkconnell Forest Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	3.5 m + verge 6.6 m	60
Macabees Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	4.1 m + verge 6.6 m	60

Table 30.2 Roads affected by the pipeline corridor

Road	Location	Sealed / Unsealed	Number of lanes and traffic direction	Width	Posted speed limit (km/h)
Phillips Boundary Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	2.5 m + limited clearances	60
Stoney Trig Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	5.2 m + verge >7 m	60
Gulf Boundary Road	Within Sunny Corner State Forest	Unsealed	Single lane, two-way	4.5 m + minimal verges	60
Sibleys Road	Minor access road north of Great Western Highway at Walang into the Sunny Corner State Forest	Sealed	Single lane, two-way	9 m + verge up to 3 m	100
Yetholme Drive	Minor access road between Sibleys Road and Great Western Highway	Sealed	Single lane, two-way	6 m + verge up to 3 m	60
Great Western Highway	State Highway 5, regional highway linking Lithgow and Katoomba to the east and Bathurst to the west	Sealed	Two lane, two way	12 m + Verge of 1-10 m	100
Private Land	Access to the land is available from private driveways from Great Western Highway and Brewongle Lane	Unsealed			
Brewongle Lane	Minor access road between Great Western Highway (north) and Brewongle Railway Station	Sealed	Single lane, two-way	6.8 m + 6 m verge	80
Private Land	Accessible via private access driveways to Brewongle Lane and Tarana Road. Other land accessed from O'Connell Road and Thomsons Hill Retreat.	Unsealed			
Rail Crossing	Main Western Line				
Private Land	Access to this land is available via private access driveways to Tarana Road	Unsealed			
Tarana Road	Minor access road between Muttons Fall Road and O'Connell Road	Sealed	Single lane, two-way	8 m + verge 5-7 m	80
O'Connell Road	Main Road 253 between Bathurst and Oberon	Sealed	Two lane, two way	7.5 m + verge 4.5-5 m	100
Private land	Access to this land is available via private access driveways to O'Connell Road and from Thompsons Hill Retreat	Unsealed			
Thompsons Hill Retreat	Minor access road running east from White Rock Road	Sealed	Single lane, two-way	6 m + 6 m verge	50
White Rock Road	Minor access road between Kelso and Penrose	Sealed	Single lane, two-way	4.2-7 m + verge on west of 6 m	80
White Rock River Lane	Minor access road between White Rock Road and the Macquarie River	Unsealed	Single lane, two-way	3-3.5 m + 2.5 m verge	50

Table 30.2 Roads affected by the pipeline corridor

Road	Location	Sealed / Unsealed	Number of lanes and traffic direction	Width	Posted speed limit (km/h)
Montavella Road	Minor access road between the Macquarie River and Gormans Hill Road	East unsealed	East: single lane, two-way	East:4.2 m + 7.5 m verge	80
		West sealed	West: single lane, two-way	West: 6.8 m + 7.5 m verge	
Gormans Hill Road	Local access road between south Bathurst and Lagoon Road	Unsealed	Single lane, two-way	7.2 m + verge 3-7.5 m	80
Lagoon Road	Rural road between Orton Park and Rockley	Sealed	Two lane, two way	8.3 m + 4 m verge	80
Vale Road	Rural road between Bathurst and Perthville	Sealed	Two lane, two way	12.5 m + 7 m verge	100
Rail Crossing	Main Western Line. Access to boring site from the eastern side of Queen Charlottes Creek and College Road				
Hen and Chicken Lane	Minor access lane between Mid Western Highway and Vale Road	Unsealed	Single lane, two-way	5-7.3 m + verge up to 8 m	50
Private land	Accessed from Hen and Chicken Lane, Trunkey Road, Wimbledon Road and Mid Western Highway	Unsealed			
Mid Western Highway	State Highway 6 between Bathurst and Hay. Access to boring sites on private land via minor road and private driveways to Mid Western Highway	Sealed	Two lane, two way	10 m + Verge 10 m	100
Private land	Access to the land is available via public and private access roads from Mid Western Highway.	Unsealed			
Dungeon Road	Rural road between Vittoria Road and Mid Western Highway	Unsealed	Two lane, two way	6.5 m	80
Pounds Lane /Gardiners Road	Connecting to Mid Western Highway to the south of Mitchell Highway to the north	Unsealed	Single lane, two-way	varies	60

30.2.2 Existing rail crossings

The pipeline corridor will cross three railway lines:

- Wallerawang Gwabegar Railway Line near the intersection of Pipers Flat Road and Range Road;
- Main Western Railway Line between Brewongle Lane and Tarana Road; and
- Main Western Railway Line at Vale Road near Orton Park.

Each of the rail crossings will be underbored. Determination of the appropriate underboring techniques will be done in consultation with John Holland (under delegated authority from Australian Rail Track Corporation).

30.2.3 Existing traffic flows and level of service

The consolidation and analysis of all the data sources to inform existing network flows is represented in Table 30.3. Generally, traffic flow is greatest at the Great Western Highway at Walang, followed by O'Connell Road at Orton Park and Vale Road at Orton Park.

The existing level of service during peak times is also represented in Table 30.3.

Table 30.3 Existing traffic flows and level of service

Location	Daily Traffic flows, vehicles per day		Peak Hour Flows, vehicles per peak hour AM (10 am-11 am) PM (4 pm-5 pm)		Level of Service Peak Hour
Pipers Flat Road - east of Irondale Road	5-day average	1,997	AM peak	160	B
	7-day average	1,867	PM peak	185	B
Sunny Corner Road – between Sugarloaf Road and Kelly Boundary Road	5-day average	131	AM peak	21	B
	7-day average	148	PM peak	44	B
Great Western Highway Walang – west of Sibleys Road	5-day average	9,651	AM peak	781	C
	7-day average	9,319	PM peak	963	C
O'Connell Road, Orton Park – north of Tarana Road	5-day average	3,455	AM peak	266	B
	7-day average	3,115	PM peak	345	B
Vale Road, Orton Park - south of Lagoon Road	5-day average	3,016	AM peak	262	B
	7-day average	2,883	PM peak	283	B
Lagoon Road, Orton Park – north of Gormans Hill Road	5-day average	877	AM peak	96	B
	7-day average	905	PM peak	114	B

The Level of Service of roads in the RMS Guide (RMS2002) provides the performance criteria for urban and rural roads. The key roads assessed for traffic flow have been graded as Level of Service B aside from Great Western Highway which has a Level of Service C. The criteria are defined as follows:

- LoS B - This level is in the zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is little less than that of the level of Service A.
- LoS C - This service level is also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.

The operation of unsealed roads is assessed against the Australian Road Research Board Unsealed Roads Manual (ARRB URM). The unsealed roads along the pipeline are one-lane two-way roads that can accommodate low traffic volumes of <150vpd. Sunny Corner Road in Table 30.3 is an example of the unsealed roads along the pipeline corridor which has traffic of less than 150 vehicles per day. The widening of carriageways is not required as clearances are provided for passing manoeuvres (ie verges are greater than 12 m – see Table 30.2).

30.2.4 Road Safety

An assessment of the Centre for Road Safety's *Crash and Casualty Statistics* database within the vicinity of the pipeline corridor was conducted showing all recorded crashes within a five year period between 2013 and 2017 which were reported to the police, on public roads, involving at least one moving road vehicle, and involved a death or injury or at least one motor vehicle being towed away.

Only five roads in the vicinity of the pipeline corridor (Table 30.4) have recorded crashes during this period, reflecting the relatively moderate flows through the road network and appropriate intersection infrastructure.

Table 30.4 Crash data summary along the pipeline corridor

Road	Number	Injuries	Type of crash
Castlereagh Highway	1	1 minor	Right rear of vehicle struck
Pipers Flat Road intersection with Range Road	2	1 Serious 1 Moderate	Both veering right off the carriageway into an object/ parked car
Great Western Highway	9	2 fatal 4 serious 2 moderate 1 minor 2 crashes had no injuries	4 veering off road to the left 2 head on 1 rear end 1 accident 1 struck animal
Gormans Hill Road	5	3 moderate 2 crashes had no injuries	4 veering off the carriageway 1 out of control
Mid Western Highway	2	1 serious 1 moderate	1 head on 1 veering off road to the left into an object

Seven of the nine crashes on the Great Western Highway occurred during dusk or in dark conditions and the two on Pipers Flat Road were at dawn or dark conditions. Construction will be carried out during daylight hours; however, caution will be required when constructing near these roads (Table 30.4) as the type of crashes indicate speed and inattention are the principal causes of accidents. A number of unsealed, relatively narrow, single lane – two-way roads to be used by the pipeline / pipeline construction crews, occur within State Forest. On 1 October 2010 Forests NSW reduced the speed limit on all unsealed gravel roads in NSW State Forests to 60km/hr in response to speed related accidents.

30.3 Impact assessment

The impact assessment of the pipeline development focused on the access, traffic and transport conditions expected during the construction of the pipeline. Moderate levels of traffic will be generated during the construction phase and temporary traffic management strategies will be required. However, it should be noted that construction related traffic impacts will be temporary.

30.3.1 Traffic related impacts during construction

i Partial road closures

The pipeline will be installed by trenching on all roads, with the exception of major RMS controlled roads. The following roads will be underbored:

- Castlereagh Highway (SH18) which the pipeline crosses north of SCSO, adjacent to pumping station facility No. 2 (approx. chainage 4,200 adjacent to the pumping station facility No.2);

- Pipers Flat Road (MR531) (in conjunction with the crossing of the Wallerawang Gwabegar Railway Line) near the intersection of Pipers Flat Road with Range Road (approx. chainage 12,600);
- Great Western Highway (SH5) which the pipeline crosses at Walang (approx. chainage 41,900) and runs adjacent to for about 2 km;
- O'Connell Road, Orton Park, which the pipeline crosses at chainage 54,300 (approx.);
- Vale Road (SR54) (in conjunction with the crossing of Queen Charlotte Creek and the Main Western Railway Line, chainage 64,300-64,900 (approx.) at Orton Park near pumping station facility No.4; and
- Mid Western Highway (SH6) where the pipeline crosses at the base of Fitzgeralds Mount (approx. chainage 82,700).

A detailed overview of these road crossings (both trenched and underbored is provided in Appendix V (Detailed pipeline corridor overview).

Trenching of the remaining roads will be undertaken in two stages with trenching and backfilling of half the road width, and then completion of the remaining half of the road crossing. Traffic movements in a single lane will be maintained in accordance with the construction traffic management plan and traffic control plans (refer Section 30.5). A typical crossing using this method will take approximately two to four days. Minor queuing and short term delays may be experienced by road users in the immediate vicinity of these partial road closures.

ii Construction traffic generation

The pipeline workforce is estimated to be 120 FTE employees during peak periods with 102 the peak number of construction staff onsite on any given day. Most of the construction workers will be transported in their crews through group transport, such as utility vehicles or mini-buses to specific work areas along the pipeline corridor. No more than 30 light vehicle trips per day are anticipated. All light and heavy vehicle parking throughout construction will be provided off-road within or adjacent to pipeline development construction sites.

It is anticipated that two to four crews will be involved in the pipeline construction. A further two crews will be working on the pumping station facilities, and a separate construction crew will be responsible for underboring works.

It is expected that crews working on the pipeline installation will be working on different sections along the 90 km pipeline corridor and therefore construction traffic generation is expected to spread geographically along the corridor with particular roads used as construction access routes for only a portion of the overall 12 month construction period. Construction access routes for the pumping station facilities will be utilised for a longer period albeit with lower expected traffic movements than pipeline installation works (refer Table 30.5).

The estimated staff, light vehicle and truck movements during construction of the pipeline and the pumping station facilities are summarised in Table 30.5.

Table 30.5 Pipeline construction traffic generation

Item	Pipeline construction	Pumping station facility construction
Time frame (days)	176	229
Peak daily staff (no. of persons)	66	36
Peak daily light vehicle movements (vehicles/day)	16	9

Table 30.5 Pipeline construction traffic generation

Item	Pipeline construction	Pumping station facility construction
Truck frequency (average movements per day)	30	2
Peak truck movements per hour	14	10
Largest vehicle size	Medium rigid vehicle	Medium rigid vehicle

Queuing of construction related vehicles on the public road network is not expected and will be managed through appropriate mitigation measures included in the project Construction Traffic Management Plan (CTMP), such as co-ordinating the movement of construction vehicles, delivery vehicles and other vehicles on site. Minor queuing during major concrete pours at the pumping station facilities may occur but will be limited in occurrence and duration.

iii Construction traffic impacts

The pipeline development traffic impact assessment found the introduction of construction traffic flows will not have a significant impact on the operation or capacity of key regional, urban, local or unsealed roads and intersections providing access to each of the pipeline development construction. Most of the vehicle trips will be undertaken outside of the local peak periods and consultation will be undertaken with the relevant agencies prior to the use of the road network.

Construction vehicle routes will be used by all construction vehicles travelling to and from the pipeline construction sites. They will be designed to provide the most efficient trips between subregional roads and the construction sites. Any oversized vehicles will require concurrence from RMS and/ or the National Heavy Vehicle Register.

The road network will be monitored during the entire construction period to ensure roads are maintained or returned (in the case of trenched road crossings) to their original condition. Prior to construction, the project manager will consult with the relevant agencies to produce an inventory of existing road conditions. At the end of the pipeline construction, the manager will meet with the relevant agencies to ensure the road network is maintained to its pre-construction conditions.

With the use of traffic control plans, the construction of the pipeline and pumping station facilities will have negligible impacts on the local road network. Additional traffic flow generated from the construction of the pipeline will not alter the level of service on key roads and intersections and therefore will not require any road upgrades to accommodate the traffic flow.

30.3.2 Traffic related impacts during operation

Scheduled maintenance or vegetation clearing for the operation of the pipeline will generate very little traffic as less than 4 vehicles trips are expected per day when these periodic events occur. It is estimated the pumping station facilities will be visited approximately weekly, however major maintenance will likely be two to three times per year. Additional trips for maintenance will utilise the same designated routes during the construction phase.

The pipeline may require emptying for maintenance and emergency drainage. Scour valves will be located at appropriate intervals along the pipeline corridor in close proximity to roads to allow for water tanker access. It is expected that minimal queuing of water tankers will be required as the pipeline can be dewatered at multiple locations along the 90 km length, ensuring any traffic impacts are diffuse and periodic.

30.3.3 Cumulative traffic impacts

Projects that may contribute to the cumulative traffic impacts along the pipeline development include Angus Place Colliery Extension Projects, Mount Panorama Second Circuit additional racetrack and Brewongle Solar Farm, however none of these have EISs which are currently under assessment and therefore, it is likely that the pipeline will be constructed without impacts from these projects. Subregional events that contribute to the cumulative traffic impacts include the Blayney to Bathurst cycle event, Central Tablelands Motorcycle Club bike ride, Bathurst Light Car Club car race and the Classic Rally Club car rally.

30.4 Management and monitoring

A CTMP will be prepared prior to construction of the pipeline as part of the CEMP. A draft of the CTMP is set out in section 5 of the Pipeline Traffic Impact Assessment contained in Appendix BB. The CTMP will identify management strategies to be adopted during the pipeline construction and will include the following factors for consideration:

- proposed work hours – including work hours that minimise disruption to road network;
- construction vehicle access route – establishing routes to the construction sites and any deficiencies that will impact the road network;
- vehicle diversion routes – detour routes implemented to maintain traffic flow in the unlikely event public roads will require temporary closure;
- traffic control for partial road closures – maximise safety by ensuring traffic control complies with best practice with vehicle movement, signage and warnings signs assessed;
- route maintenance – road network will be maintained to its pre-construction condition, and in accordance with the inventory to be documented with relevant agencies;
- construction staff parking – parking to be provided on-site and staff transported by group transport where possible;
- driver code of conduct and inductions – all drivers to adhere to the driver code of conduct and subcontractors are to be inducted with procedures for vehicles entering the construction areas;
- development of monitoring program – project manager on site to monitor and document the effectiveness of the CTMP; and
- communications strategy – notify and engage all stakeholders and landowners of traffic changes anticipated prior to works commencing.

30.5 Conclusion

Construction related traffic generated during construction of the pipeline development will not have a significant impact on the operation or capacity of key regional, urban, local or unsealed roads and intersections providing access to each of the pipeline development construction sites. The light vehicle generation is considered very moderate, estimated up to 30 vehicle trips (including minibuses) per day with heavy vehicle movements being on average 32 movements per day. All construction related vehicles will use dedicated construction routes between the individual pipeline development construction sites and the regional road network.

Key regional roads will be underbored to avoid any impact to traffic using these roads. Queuing and delays may be associated with partial road closures to accommodate trenched road crossings; however, impacts will be limited in any one location up to two days.

A CTMP will be prepared prior to construction of the pipeline as part of the CEMP. The CTMP will identify management strategies to be adopted during the pipeline construction to effectively manage traffic during construction so as to avoid impacts on the road network.

Chapter 31

Hazard and risk

31 Hazard and risk

31.1 Introduction

This chapter provides an assessment of hazard and risks to public safety that may result from the construction and operation of the pipeline. Potential risks such as bushfire hazards and transport and storage of dangerous goods have been assessed to ensure the development satisfies work, health and safety standards. Risks and hazards identified require control measures and a risk management process. Potential risks associated with the potential presence of acid sulfate soil, pre-existing contamination or naturally occurring asbestos are discussed in Chapter 23 (Soils and land resources) and release of drilling fluids arising from underboring are discussed in Appendix X (Water resources assessment).

The EARs require hazards and risks resulting from the construction and operation of the pipeline to be assessed. The requirements are presented in Table 31.1.

Table 31.1 Hazard and risk related EARs for the pipeline development

Requirements	Where addressed
Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential geochemical and bushfire risks, and storage, handling, transport and use of any dangerous goods.	This chapter

31.2 Identification of hazards and risks

The hazards and risks identified for the pipeline development include:

- bushfire risks;
- unplanned discharges from the water supply pipeline releasing raw treatment water to the environment; and
- storage and transport of hazardous goods and materials.

31.2.1 Bushfire

An assessment of potential hazards associated with bushfire and recommendations for mitigation measures, in consideration of the NSW *Rural Fires Act 1977* and *Planning for Bushfire Protection* (RFS 2006 and 2018) (PBP), has been undertaken.

The typical climate in the area is characterised by cold to very cold winters followed by hot dry summers, with rainfall experienced all year round but slightly decreased during the winter months. Average annual rainfall generally decreases from east to west. The pipeline corridor experiences gusty north-westerly winds, high daytime temperatures, low humidity and dry lightning storms during the bushfire season which extends October to March in the west near the mine (Canobolas Bushfire Management Committee (BFMC) area), and November to March around Lithgow (Lithgow BFMC area). The Central Ranges region has been rated by the NSW Rural Fire Service (RFS) as having a fire danger index (FDI) of 80. The FDI rating is used to inform bushfire behaviour based upon broad characteristics and is one factor considered when determining bushfire risk.

Much of the eastern portion of the pipeline corridor (approximating 50% of the total length) from Centennial's Angus Place and SCSC operations to the intersection point with the Great Western Highway are mapped as bushfire prone land (Blackmans Flat, Portland, State Forests from Portland to Yetholme and Fitzgeralds Mount). Land occupied by the western component of the pipeline corridor (Great Western Highway to Vittoria State Forest) is generally not considered to be bushfire prone, while the area from Vittoria State Forest to the mine is mapped as bushfire prone (Figure 31.1).

Around 30 % of the pipeline corridor traverses through land mapped as bush fire prone with the eastern portion of the pipeline corridor, in the vicinity of Sunny Corner and Winburndale Nature Reserve, having the highest risk of bushfire occurrence.

Other relevant factors in considering bushfire risk are vegetation characteristics and slope. The project area consists of native vegetation which aligns with woodland, forest, grassland and freshwater wetland vegetation formations. Of these, the grassland vegetation classification is the most prevalent of the mapped vegetation. The landscape is gently undulating with some areas of steeper slopes. The steeper slopes are considered to be a bushfire hazard, as they can accelerate the rate at which a bushfire spreads.

Existing sources of ignition of unplanned fires could be:

- lightning strikes;
- electrical infrastructure failures;
- arson;
- machinery;
- vehicles; and
- welding and grinding activities.

During the construction site compounds, laydown, equipment and temporary storage areas are at risk if not sited appropriately and in response to bushfire risk. During construction and operation (during routine maintenance) there is also the risk of bushfire ignition, particularly on days of total fire ban. Possible sources include:

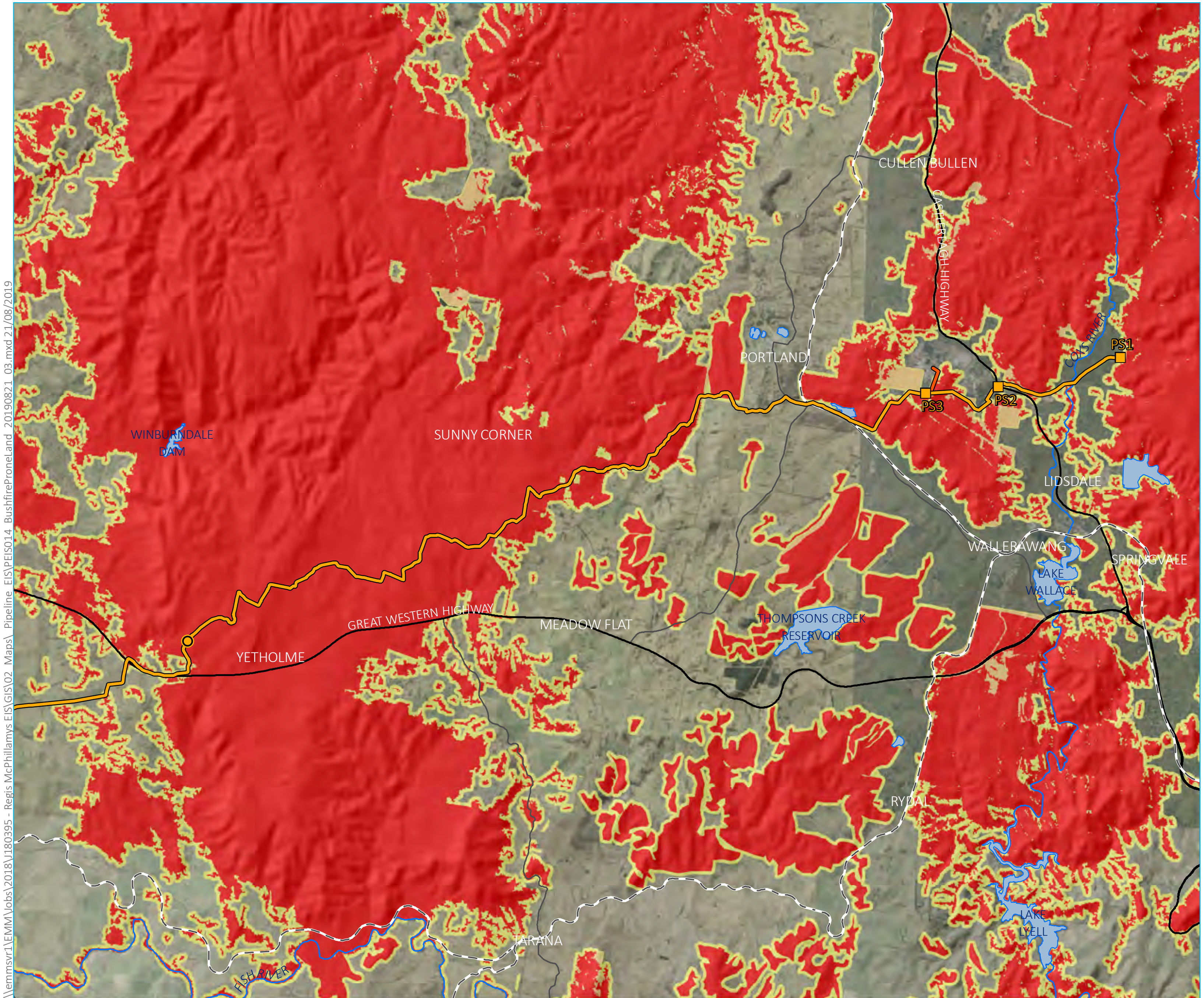
- diesel generators;
- storage and transportation of flammable liquids (eg fuel storage) and explosives;
- vehicle and machine movement over long grass;
- sparks generated from hot works (eg welders and grinders);
- human error, such as non-compliance with hot works procedures or incorrect disposal of cigarette butts; and
- sparks from overhead powerlines.

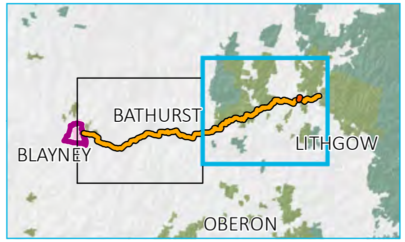
Although the pipeline itself will generally not be affected by bushfire due to it being buried, above ground infrastructure associated with it will potentially be at risk. At-risk permanent infrastructure includes pump station facilities, pressure reducing system, electricity supply and communications systems. Pump stations facilities and pressure reducing system will be housed in a building or shed enclosure and will require the establishment of asset protection zones.

Given the proposal will be located within bushfire prone land, the following bushfire management aspects will be incorporated into the CEMP for the pipeline:

- refuelling away from vegetation;
- if hot work is required, welding equipment will not be operated in the vicinity of bushland environments within high bushfire danger periods and hot works will not take place on total fire ban days unless RFS approval is obtained;
- a hot works procedure will be documented in the CEMP;
- provision of suitable training and adequate supervision when undertaking activities that have the potential to cause fires;
- emergency and evacuation procedure; and
- suitable fire suppression equipment such as fire extinguishers will be provided at construction compounds, refuelling areas and in each construction vehicle during construction.

During operations asset protection zones and appropriate fire suppression equipment (such as extinguishers and fire hoses) will be maintained around pumping station facilities and the pressure reducing system.





KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Bushfire prone land category

- Vegetation category 1
- Vegetation category 2
- Vegetation category 3
- Buffer

Source: EMM (2019); Regis Resources (2019); DFSI (2017); RFS (2015); GA (2011)

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Bushfire prone land mapping - pipeline development

McPhillamys Gold Project
Environmental impact statement
Figure 31.1a

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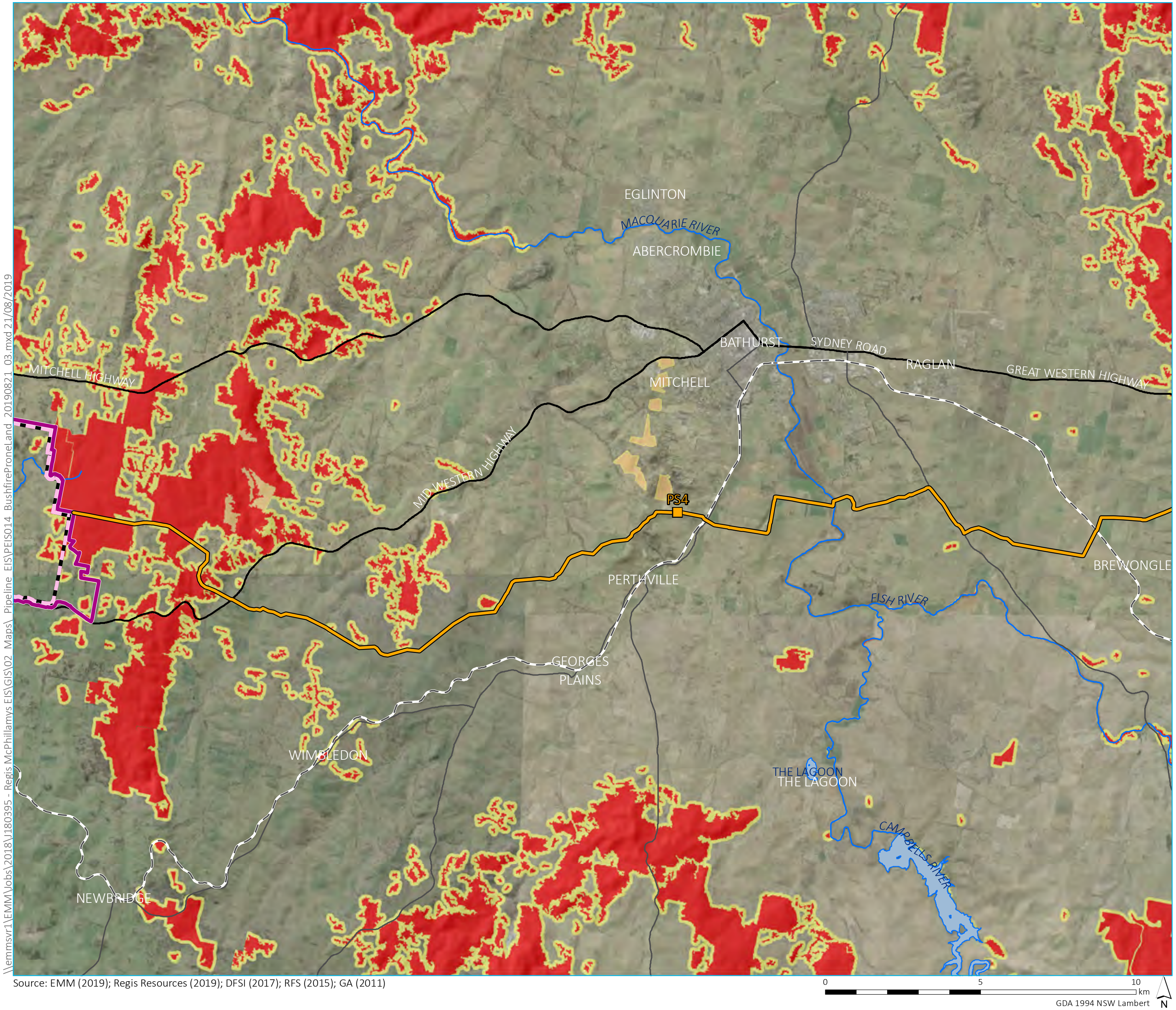
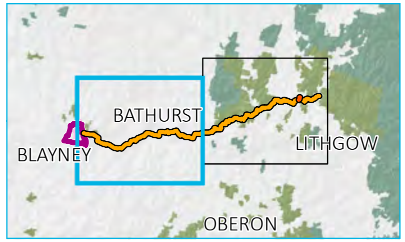
EMM creating opportunities





KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment
- Rail line
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- Waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Bushfire prone land category
- Vegetation category 1
- Vegetation category 2
- Vegetation category 3
- Buffer

Source: EMM (2019); Regis Resources (2019); DFSI (2017); RFS (2015); GA (2011)

Bushfire prone land mapping - pipeline development

McPhillamys Gold Project
Environmental impact statement
Figure 31.1b

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31.2.2 Unplanned discharges

In the event of a pipe discharge, surface water and groundwater could be affected through runoff of raw water and localised water quality impacts could be experienced in local waterways. Localised erosion could occur, depending upon volumes discharged, local topography, soils and extent of vegetation.

Pipe discharges during operation of the pipeline therefore presents a potential contamination risk if not dealt with effectively. In the event of a pipeline discharge, it is predicted that less than 1 ML of water could be discharged to the environment. The impact of pipe discharges on surface and groundwater is discussed in Chapter 24.

Isolation or section valves will be provided to isolate the pipeline into discrete sections in the event of pipe discharges. Fault detection and telemetry systems will be incorporated within the pipeline design. In the unlikely event of a pipe leak, the fault detection systems will shut down water flow. In accordance with the operations protocol personnel will be dispatched to inspect and isolate the pipeline and arrange for any necessary repairs.

31.2.3 Storage and transport of hazardous and dangerous goods and materials

i construction

Hazards and risks associated with construction include:

- during construction small volumes of fuels and chemicals may be stored on work sites for use by machinery and equipment. There is potential for these substances to spill into the surrounding environment during refuelling activities, transport and delivery spills and enter surface and groundwaters or contaminate soil; and
- bushfire impacting on hazardous goods stored at construction compounds and work fronts or used within plant and equipment (ie fuels and oils), resulting in a release into the environment.

Management measure to address the risks associated with the use and storage of hazardous materials during construction of the pipeline development will be included in the CEMP and will include:

- ensuring handling and storage of fuels, flammable materials, chemicals and hazardous materials are stored in appropriately sized, segregated, bunded stores within designated and secured work compounds during construction;
- designated refuelling areas;
- incident and emergency response procedures; and
- spill response kits to be provided in construction compounds, refuelling areas and construction vehicles.

ii Operation

Hazards and risks associated with the operation of the project include:

- minor quantities of fuels, lubricants and chemicals may be stored for maintenance activities in and around the compounds of pumping station facilities and the pressure reduction system; and
- potential requirement to store small quantities of chlorine and other hazardous materials (fuels and oils) at pumping station facilities.

As described in Chapter 2, the requirement for cleaning stations along the pipeline corridor will be determined during the detailed design phase. If cleaning stations are required, chlorine will be stored in an appropriately bunded areas within the pumping station facilities in accordance with the requirements of all relevant Australian Standards. Spill kits will also be stored at the pumping station facilities. The quantities of any hazardous goods stored or handled at the pumping station facilities or along the pipeline corridor will be below threshold quantities listed in Applying SEPP 33 (DoP 2011).

Management of any hazardous materials required during the operation of the pipeline development will be addressed in the OEMP for the project.

Chapter 32

Visual amenity

32 Visual amenity

32.1 Introduction

This chapter provides a visual assessment of the pipeline development. The pipeline development is mostly below ground, with above ground elements comprising four pumping stations (three of which are on existing mine and infrastructure sites), a pressure reducing system, and valves approximately every 1-2 km along the pipeline. The EARs relating to visual amenity are presented in Table 32.1.

Table 32.1 Visual impact related EARs

Requirement	Where addressed
Visual – including an assessment of: the likely visual impacts of the development on private land in the vicinity of the development and key vantage points in the public domain, paying particular attention to any temporary and permanent modification of the landscape (eg overburden dumps, bunds, tailings facilities), and	This chapter with regards to the pipeline development
the lighting impacts of the development.	Section 32.5.1

32.2 Visual assessment methodology

An assessment of the existing visual character and potential visual impacts was completed qualitatively, given that, once constructed, the majority of the pipeline will be buried below-ground, with limited permanent surface features. For the features that will be permanent, the assessment considered:

- sensitivity of the existing area or view to change, for example a natural environment is more sensitive than an industrial area; and
- magnitude, including the scale, contrast, quality or distance of the proposal on that area or view, including the design quality.

The following tasks were completed:

- identification of key viewpoints (ie potentially affected receptors), based on site observations, aerial photography and mapping that will have views of permanent above-ground infrastructure;
- analysis of the existing visual character in the vicinity of permanent infrastructure;
- assessment of visual impacts; and
- consideration of mitigation measures.

32.3 Existing environment

32.3.1 Visual character

Due to the linear nature and overall length of the pipeline, the pipeline development was broken into four broad visual character types to characterise the existing visual environment along the pipeline. These were based on areas displaying similar landscape and physical qualities and are presented in Figure 32.1. The four visual character types and the relevant elements of the pipeline development that will be present in each are summarised in Table 32.2.

Table 32.2 Visual character types and the relevant elements of the pipeline development

Visual character type	Pipeline development elements present	Description	Sensitivity
Industrial (mining and electricity generation)	Pipeline and pumping station facilities 1, 2 and 3	Dominant land uses are mining, power generation and other industrial land uses. Visible infrastructure such as coal stockpiles, coal handling and transport infrastructure, buildings, emission stacks, power generation facilities and transmission infrastructure.	**Negligible** Highly disturbed and capable of absorbing change.
Open farmland	Pipeline	Dominant land uses characterised by farming and agriculture, with cleared or partially cleared landscapes and undulating landform above river corridors. A number of watercourses occur through these areas including Saltwater Creek, Evans Plains Creek, Queen Charlottes Creek and the Macquarie River. Tree cover is generally sparse and disconnected, with some areas of remnant vegetation remaining. Built form comprises dwellings on large rural residential lots, with some smaller areas of low density residential development near towns. Primarily open in character with distant views.	**Moderate** The undulating character provides numerous low ridgelines limiting sight lines. Sparse vegetation limits the potential for screening.
Open woodland	Pipeline and pumping station facility 4	Undulating landscapes with some steep hillsides, primary native woodland, cleared for roads/infrastructure in some places. A number of watercourses occur through these areas. Built form comprises low density farm dwellings and rural residential. Views from vantage point points are typically interrupted by vegetation and undulating landscape features, although some areas have distant views.	**Moderate** Open woodland and undulating landscape provide screening.
Forestry	Pipeline and the pressure reducing system	Undulating landscapes, with some steep ridges. A number of watercourses occur through these areas. Vegetation comprises dense plantation forests and plantation forests at various stages following harvesting. Infrastructure and built form is typically limited to forest access roads and transmission infrastructure.	**Low** Densely forested plantation vegetation and undulating/varied topography provide screening.

32.3.2 Identification of viewpoints

To assess visual impacts of the permanent features within the pipeline corridor, viewpoints were selected using aerial photography and mapping. Where viewpoints were identified on private land where access was not possible, photographic survey was conducted from the entrance to the property driveway or other nearby location to represent the view from which permanent features of the pipeline development may be visible from the selected viewpoint. The viewpoints (visual receptors) are presented in Figure 32.2 and listed below:

- Viewpoint 1: Castlereagh Highway looking towards pumping station facility No. 2.
- Viewpoint 2: Sibleys Road looking towards pressure reducing system.
- Viewpoint 3: Bathurst Bike Park looking towards pumping station facility No 4.

32.4 Impact assessment

32.4.1 Visual features of the pipeline development

The pipeline corridor will accommodate all components of the pipeline development including pumping station facilities and associated pipeline infrastructure as described in Section 2.

The pipeline corridor is described in detail in Section 2.14. The proposed route of the pipeline corridor is shown in Figures 2.2a to 2.2h. The key permanent features of the pipeline development include:

- a pipeline approximately 90 km in length, starting at Angus Place and finishing in the mine development project area. The corridor width typically varies from approximately 6-20 m (excluding the four pumping station facilities) and will be buried below-ground for the majority of the route;
- an ancillary corridor approximately 1 km in length which will accommodate a small pipeline required to transfer water from the Blowdown Pond at MPPS over land owned by EA to the pumping station facility No.3 at MPPS;
- four permanent above-ground pumping station facilities. The corridor width extends to an area of up to 75 m by 75 m at these locations for pumping stations 1-3, and 35 m by 50 m for pumping station 4; and
- a permanent above-ground pressure reducing system.

Of the four pumping stations, three will be located on land owned by Centennial and EA in proximity to existing mining and power generation operations. One pumping station (pumping station facility No. 4) will be located on public land managed by Bathurst Regional Council. The pressure reducing system will be located on land owned by the Forestry Corporation of NSW.

Temporary features during construction along the pipeline corridor will include construction compounds, laydown and stockpile areas as well as construction machinery, equipment delivery and personal vehicles moving along the corridor.

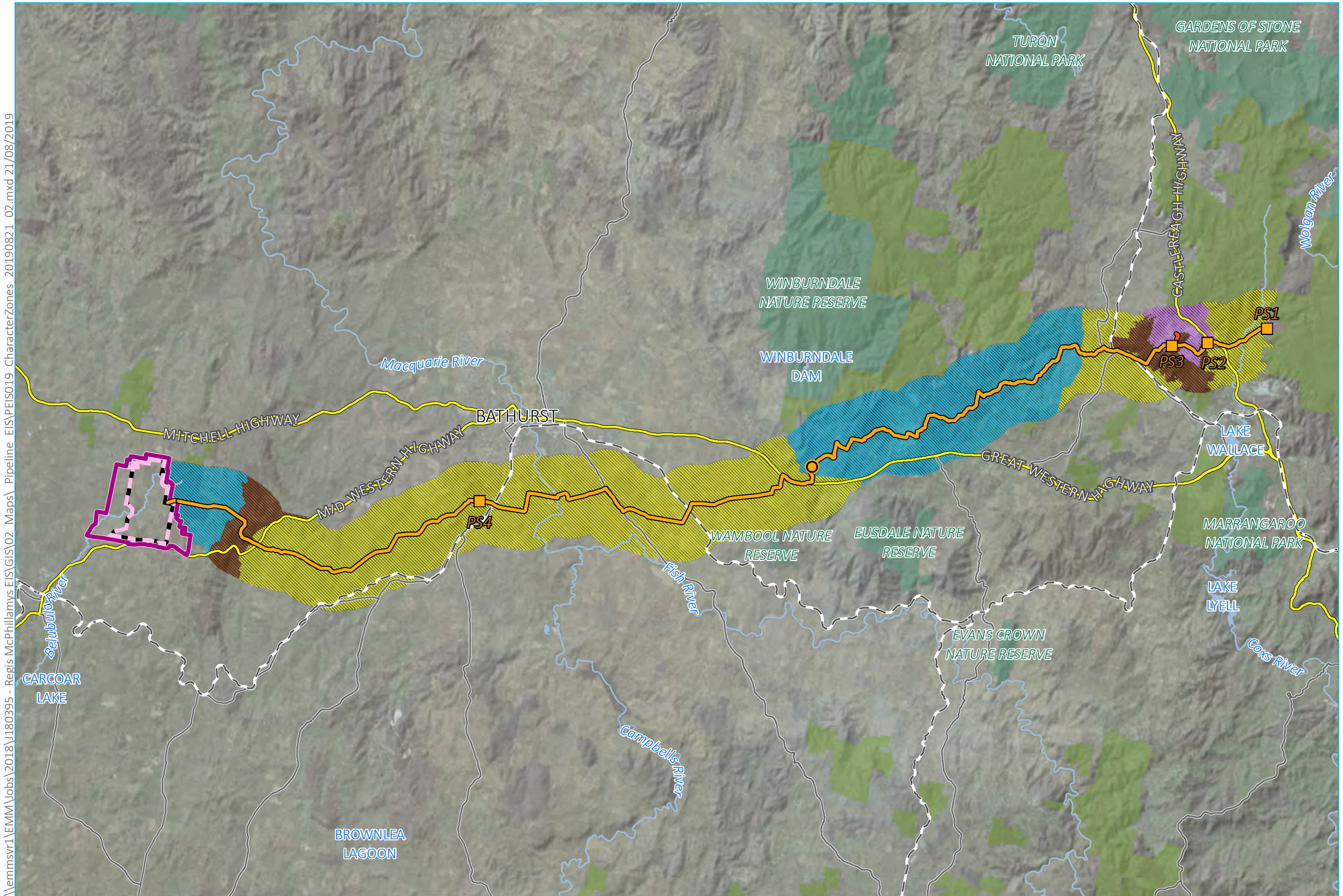
A summary of permanent above-ground visual features of the pipeline development is provided in Table 32.3. The main permanent infrastructure includes pumping station facilities, pressure reducing system, valves and the pipeline easement. There will be temporary visual elements during the construction phase including construction compounds and plant and machinery associated with construction activities.

LCZ1 - INDUSTRIAL

LCZ2 - OPEN FARMLAND (WITH RESIDENCE)

LCZ3 - OPEN WOODLAND

LCZ4 - FORESTRY



Source: EMM (2019); Regis Resources (2019); DPE (2018); DFSI (2017); GA (2011)

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KEY

- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pressure reducing system
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest

Landscape character zones

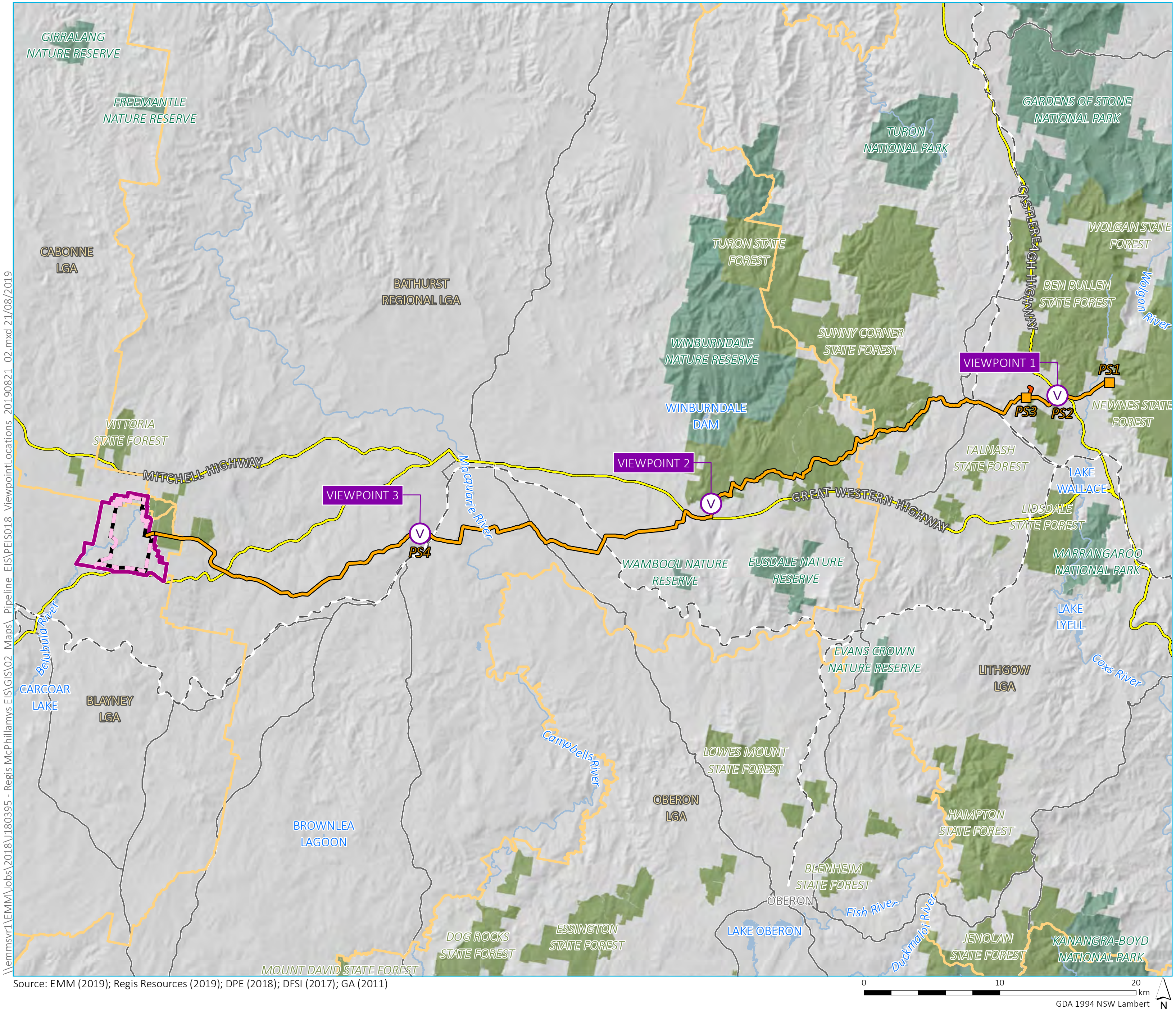
- LCZ1 - Industrial
- LCZ2 - Open farmland
- LCZ3 - Open woodland
- LCZ4 - Forestry

Landscape character types - pipeline development

McPhillamys Gold Project
Environmental impact statement
Figure 32.1

REGIS RESOURCES LTD

EMM creating opportunities



Source: EMM (2019); Regis Resources (2019); DPE (2018); DFSI (2017); GA (2011)

KEY

- Viewpoint location
- Mine development project area (2,513.47 ha)
- Mining lease application area (1,812.99 ha) (Note: boundary offset for clarity)
- Pumping station facility
- Pipeline corridor
- Pipeline corridor (Blowdown Pond)

Existing environment

- Rail line
- Primary road
- Arterial road
- River
- Waterbody
- NPWS reserve
- State forest
- Local government area

Location of viewpoints - pipeline development

McPhillamys Gold Project
Environmental impact statement
Figure 32.2

Table 32.3 Key pipeline development features and visual receptors

Infrastructure	Permanent features	Main viewers/receptors
Pumping Station Facilities	• Pumping station facility contained in covered building – approximately 4 m high, 12 m long and 6m wide. • Water storage tank - approximate dimensions of 6-9 metres high and diameter of between 11 m to 14 m. The tank will be constructed of concrete or steel. • Control room contained in brick building – approximately 4 m high, 8 m long and 6m wide. • Final site dimensions of 75 m x 75 m (5,625 m^2), except for pumping station facility 4 (Bathurst Bike Park which fenced site dimensions of 35 m x 50 m (1,750 m^2). • Site compounds will be enclosed by a 1.8 m high fence.	Viewpoint 1: view of pumping station facility No. 2 from Castlereagh Highway. Viewpoint 3: view of pumping station facility No.4 from Vale Road and the Main Western Railway Line, the Bathurst Bike Park, "The Junktion" reuse and recovery centre, Bathurst waste management centre, Hen and Chicken Lane, rural properties and distant view from residences.
Pressure Reducing System	• Enclosed concrete, brick or steel building approximately 4 m high, 8 m long and 6 m wide with noise mitigation measures and vents. • Fenced site area of 400 m^2 and a 1.8 m high fence.	Viewpoint 2: Direct views of pressure reducing system from adjoining forestry land and trails, Sibleys Road and Old Airstrip Road.
Valves	• Several different types of valves will be located at regular intervals along the pipeline, including isolation valves, scour valves and air release valves. • Air valves and scour valves will be located at various points along the pipeline with the final location to be determined at detailed design.	The final locations will be determined during detailed design. They are not expected to have a significant visual impact due to their limited size and position flush with the existing ground level.

32.4.2 Visual impact assessment

The potential impacts on visual landscape character during construction and operation are summarised in Table 32.4**Error! Reference source not found.**. Visual impacts during construction will be temporary along the pipeline route, and will typically include construction vehicles, stockpiles and construction zones, however many of these areas are located away from public views and views from residences. Where the pipeline construction is visible, potential visual impact will be generally limited, in any one location, up to a week for conventional trenching pipeline installation and up to six weeks for underboring installation as construction progresses along the corridor. Construction of pumping station facilities with generally take between four and six months. Construction compounds and laydown areas will also move as construction progresses but may be in place in any one location for up to six months. These will be located as far as practicable to take advantage of existing screening.

Table 32.4 Visual character type impact assessment

Phase	Industrial	Open farmland	Open woodland	Forestry
Construction	Pumping station facilities No.1, No.2 and No.3 will be permanent features of this landscape, however will be located on land already dominated by mining and power generation infrastructure and which has an increased capacity to absorb change. **Magnitude of impact is low.**	Development involves clearing and grading for pipeline trenching and some underboring at creek crossings. Compounds and laydown areas in road corridors and on private property. **Magnitude of impact is moderate.**	Pipeline trenching and construction of pumping station facility No. 4 at Bathurst Bike Park. Some clearing for construction purposes, although the quantum of vegetation removal us relatively small. **Magnitude of impact is moderate.**	Involves pipeline trenching mostly along roadsides and construction of the pressure reducing system. Some clearing impacts, although relatively small. Placement of compounds and laydown areas in cleared areas. **Magnitude of impact is low.**
Operation	Pumping station facilities No.1, No.2 and No.3 located adjacent to other mining/energy generating infrastructure. Pumping station facility 2 visible to sensitive receivers and road users on Castlereagh Highway. **Magnitude of impact is low.**	The easement corridor is permanent but generally not visible due to open nature of vegetation. Pipeline will be below ground with small, above ground valves every 1 to 2 km. **Magnitude of impact is low.**	The easement corridor is permanent but generally not visible due to open nature of vegetation. Pipeline will be below ground with small, above ground valves every 1 to 2 km. Pumping station facility No.4 is in close proximity to a waste management centre which has moderate capacity to absorb visual changes. **Magnitude of impact is low.**	The easement corridor is permanent but generally not visible as it is generally along the existing roads and tracks. The pressure reducing system is not visible to sensitive receivers and will be located in an already disturbed area. **Magnitude of impact is low.**

32.4.3 Visual assessment of permanent features

An assessment of the impacts of visual permanent features to landscape character during the construction and operation of the pipeline development was completed. The assessment considered both the visual sensitivity and magnitude of impact associated with these features.

The pipeline is to be installed below ground level and will not be visible following construction apart from small valves boxes which will be installed flush with the existing ground level (refer Section 2.14.7). However, clearing maintenance of the easement will be evident in some locations along the corridor.

During operation, the four pumping station facilities and the pressure reducing system will have the greatest magnitude of impact.

i Pumping station facility No.1

Pumping station facility No.1 will be located adjacent to a track off Wolgan Road, and will include a pumping station building, above ground water storage tank, above ground pipeline and valving, a control room and a pad mounted power transformer. No private properties overlook the pumping station facility and it will not be visible from the main road due to vegetation screening. It is located adjacent to a large coal loading facility which is the prominent feature in the landscape.

ii Pumping station facility No.2

Pumping station facility No.2 will be visible to motorists on the Castlereagh Highway. Infrastructure will be located approximately 60 m from the road.

A rendering of the approximate scale and visual appearance of features have been overlaid on image to give an indication of the visual character of the infrastructure (refer Plate 32.1). Motorists will be travelling at 100 km/hour in both directions therefore exposure will be brief. Given the substantial infrastructure in the vicinity of this location including coal stockpiles, mining and power station infrastructure, the addition of the pumping station facility is considered to represent a low impact.

Photograph 32.1 Viewpoint 1 – Existing environment

Plate 32.1 Indicative pumping station facility No.2 arrangement from Viewpoint 1

iii Pumping station facility No.3

Pumping station facility No.3 is located within the Mt Piper Power Station complex and will not be visible to external receptors.

iv Pumping station facility No.4

Pumping station facility No.4 is located near Bathurst Bike Park, Bathurst Waste Management Facility and 'The Junktion' at Bathurst Community Recycling Centre. The pumping station facility will be visible by users of these facilities. A rendering of the approximate scale and visual appearance of features has been overlaid on image to give an indication of the visual character of the infrastructure when viewed from Bathurst Bike Park (refer Plate 32.2). The upper landscape position and filtering from trees helps limit long distance views to the pumping station facility. Views of the infrastructure will be filtered by existing vegetation.

Photograph 32.2 Existing environment – Viewpoint 3

Plate 32.2 Indicative pumping station facility No.4 arrangement from Viewpoint 3

v Pressure reducing system - Sibleys Road

The pressure reduction system will be visible from forestry tracks, accessible to vehicles and recreational users travelling along Sibleys Road. A rendering of the approximate scale and visual appearance of features has been overlaid on image to give an indication of the visual character of the infrastructure (refer to Plate 32.3). Powerlines are already a dominant landscape feature at this location. The addition of the pressure reduction system is considered to represent a low impact.

Photograph 32.3 Existing environment – Viewpoint 2

Plate 32.3 Indicative pressures reducing system arrangement from Viewpoint 2

32.5 Mitigation and monitoring

The pipeline development has been designed to minimise the visual impacts through careful consideration during route design. The following mitigation measures will be implemented during the detailed design and construction phases to minimise the potential visual amenity impacts of the pipeline development.

32.5.1 Design

The detailed design will consider building materials and treatments to minimise the potential visibility of the projects, including the following measures:

- Pumping station facilities and pressure reducing system:
  - where sites are not flat, pumping station facilities and the pressure reducing system will be cut into the site so that the infrastructure 'sits' within the landscape and is has less visual bulk. Surplus material will be used for earth mounding and landscaping;

  - screening vegetation will be planted at various heights to filter views to the structures from public viewpoints. Screening plants will be of local and native species where possible, chosen from those common to the surrounding ecological community;

  - finishes and materials will be selected to assist in blending into the surrounding landscape, with attention paid to reflectivity;

  - lighting for the pumping station facilities will be in accordance with Australian Standard 4282 Control of Obtrusive Effects of Outdoor Lighting. Lighting protocols will adopt the following principles:

    - operational protocols for mobile lighting to direct it away from external private receptors;

    - lighting sources will be directed below the horizontal to minimise potential light spill;

    - light systems will be designed to minimise wastage;

    - screening of lighting will occur where possible; and

    - lighting of light coloured surfaces with greater reflectivity will be avoided.

- Pipeline:

  - the pipeline corridor has been routed to avoid dense areas of vegetation and significant trees, and minor adjustments will continue to be made during detailed design to continue to minimise vegetation removal;

  - disturbed ground will be rehabilitated as quickly as possible to return the corridor to its original state;

  - where vegetation is removed for pipeline construction and ongoing clearance requirements, consideration will be given to supplementary planting adjacent to the corridor to reduce the visual impact. This will be in consultation with the landowners; and

  - where pipeline valves will be close to residences, screening by shrubs and grasses will be considered in consultation with the landowners.

- Site compounds:

  - will be located in existing cleared areas;

  - siting of stockpiles as far as practicable away from the sight lines from sensitive receivers; and

  - have sites close to existing access routes and gates in fencing.

32.5.2 Construction

The following measures will be included in the pipeline development CEMP to manage visual amenity impacts during construction:

- existing roads, tracks and disturbed areas will be used as far as practicable to minimise disturbance and visual impacts;

- storage areas and construction plants, stockpiles and access roads will be located away from residences and recreational areas where practicable to reduce visual impact; and
- screening vegetation will involve a selection of local and native species with a mix of heights such as grasses, mid-storey and shrubs and trees. Any replanting within the state forests would be undertaken in consultation with the Forestry Corporation of NSW.

32.5.3 Operation

Ongoing maintenance and management of vegetation including screening plantings will also include long term weed control, erosion control and growth monitoring in accordance with the overall OEMP for the project.

32.6 Conclusion

The pipeline development will not have significant visual impacts along the pipeline corridor. Construction impacts will be temporary in nature and will move progressively along the pipeline corridor. Once constructed, the majority of the pipeline development is below ground, with only the pumping station facilities, pressure reducing system and valves visible above ground during the operational phase. Pumping station facilities No.1, No.2 and No.3 are located on existing mine and infrastructure sites which have a high visual absorption capacity. Pumping station facility No.4 near Bathurst Bike Park will be visible from public viewpoints in the area; however, it is located within existing screening vegetation. Measures to mitigate visual impacts will be implemented to further minimise visual impacts during construction and operation.

Chapter 33

Social assessment

33 Social assessment

33.1 Introduction

A social impact assessment (SIA) was prepared by Hansen Bailey for the pipeline development in accordance with the *Social Impact Assessment Guidelines for State Significant mining, petroleum and industry development* (DPE 2017) (the SIA guidelines). The assessment identified the potential impacts and opportunities associated with both the construction and operational phases of the development, as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

The SIA considered both the mine development and the pipeline development. This chapter summarises the SIA of the pipeline development, whilst Chapter 20 summarises the SIA of the mine development. The full SIA report is attached in Appendix T.

The EARs assessment requirements and guidelines are presented in detail in Table 33.1.

Table 33.1 Social impact related EARs

Requirement	Where addressed
the likely social impacts of the development; and	SIA section 10 (Appendix T) Section 33.3 of EIS
the likely economic impacts of the development, paying particular attention to: the significance of the resource;	N/A to pipeline development
economic benefits of the project for the State and the region; and demand for the provision of local infrastructure and services.	SIA section 10.2.9, 10.2.10 and 10.5. (Appendix T) Section 33.3.2iii and 33.3 iv of EIS

The SIA methodology involved scoping, to identify key stakeholders and preliminary social impacts, a baseline study consisting of desktop research and primary data collection, and impact assessment. Mitigation measures were identified and a significance assessment of each social impact and opportunity was undertaken both before and after mitigation. Levels of significance were assessed as low, moderate or high.

33.2 SIA consultation

Hansen Bailey (2019) consulted with the following stakeholders relevant to the pipeline development as part of the SIA consultation:

- landowners located within the pipeline corridor and directly impacted by the pipeline construction;
- Blayney Shire Council;
- Bathurst Regional Council;
- Lithgow City Council;
- Registered Aboriginal Parties (RAPs) and the Wiradjuri People; and
- accommodation providers in the LGAs of Blayney, Bathurst and Lithgow.

33.3 Existing social environment

The pipeline traverses the Bathurst, Lithgow and Blayney LGAs. An overview of the social baseline characteristics of these LGAs is provided below.

33.3.1 Lithgow local government area

The eastern part of the pipeline corridor will be located within the Lithgow LGA. Land uses are identified in Figure 5.9. The Lithgow area is predominantly rural, with rural-residential and residential areas in several townships, and some industrial land use. Settlement is based in the township of Lithgow, the smaller townships of Portland and Wallerawang, and numerous other small villages. Rural land is used mainly for farming, grazing and mining (particularly coal mining).

In 2018, the population of the Lithgow area was 21,636 people. Overall, 92.3% of the labour force were employed and 7.7% unemployed, compared with 93.8% and 6.2% respectively for the Central West statistical division (CWSD). The 2016 census data indicated that the labour force size of Lithgow local government area was 8,445.

33.3.2 Bathurst local government area

The middle part of the pipeline corridor will be located within the Bathurst LGA. Land uses are identified in Figure 5.9. The Bathurst LGA is a rural and expanding residential area. Settlement is based in the township of Bathurst, and numerous small villages. Rural land is used primarily for timber production and agriculture, particularly sheep and cattle grazing, with some orcharding, crop farming and market gardening.

Bathurst is located at the cross roads of the Great Western, Mid Western and Mitchell Highways and on the Blue Mountains Line on the Intercity Trains Network with a daily service to Sydney.

In 2018, the population of the Bathurst area was 43,206 people. Overall, 94% of the labour force were employed and 6.% unemployed, compared with 93.8% and 6.2% respectively for the CWSD. The 2016 census data indicated that the labour force size of Bathurst local government area was 19,329.

33.3.3 Blayney local government area

The western part of the pipeline corridor will be located within the Blayney LGA. Land uses are identified in Figure 5.9. The Blayney LGA is predominantly rural, with agriculture and mining remaining the dominate land uses. with rural-residential and residential areas in several townships, and some industrial land use. Settlement is based in the township of Blayney and the historic villages of Barry, Carcoar, Lyndhurst, Mandurama, Millthorpe, Neville and Newbridge.

In 2018, the population of the Blayney area was 7,342 people. Overall, 94.2% of the labour force were employed and 5.8% unemployed, compared with 93.8% and 6.2% respectively for the CWSD. The 2016 census data indicated that the labour force size of Blayney local government area was 3,966.

33.3.4 Pipeline corridor social environment

The land uses of the pipeline development are dominated by state forests, agriculture (grazing and cropping), road and track reserves, and mining and energy generation in the eastern portion of the pipeline corridor. Pumping station facility No. 4 will be within the Bathurst Bike Park and adjacent to the Bathurst Waste Management Centre where other uses include a recycling centre and landfill.

No items of historic heritage will be directly impacted by the pipeline development. Seven Aboriginal cultural heritage sites have been identified in the corridor – six isolated artefacts and one low density scatter of two artefacts.

The landholders directly affected by the pipeline development include:

- sixteen private landholders;
- landholders associated with Angus Place, Centennial Coal and Energy Australia;
- land owned and managed by Lithgow and Bathurst Councils; and
- five crown entity lands (Forestry Corporation (a state-owned corporation), RMS, DPI Fisheries, Department of Industry (Crown Land) and Transport for NSW - Railcorp).

33.4 Social impacts and opportunities

33.4.1 Employment opportunities

The pipeline development will result in the creation of a number of direct and indirect employment opportunities. The pipeline development will require a peak construction workforce of 120 people. The construction of the pipeline development will require a labour force with specialised skills. It is therefore anticipated that the majority of the construction workforce for the pipeline development will be non local hires (NLHs). An estimated 20% (24 persons) are anticipated to be local hires. The majority of non local hires are anticipated to be sourced from outside the Central West Region.

Regis will seek to prioritise the local employment of suitable applicants. Given the skill requirements, it is unlikely that the pipeline development will attract more than 20% of its workforce from the Local Area. Whilst the likelihood of local employment on the pipeline development is almost certain, the overall employment benefit of the pipeline corridor to the local area is considered minor.

33.4.2 Short-term accommodation demand

The pipeline development will generate demand for an estimated 100 beds of short-term accommodation during the 12 month construction phase. Multiple workfronts will operate at the same time for the pipeline development. Hence accommodation demand is likely to be dispersed across the LGAs of Bathurst and Lithgow and to a much lesser extent Blayney. More than likely Bathurst and Lithgow LGA will accommodate the majority of the pipeline development workforce. Both Bathurst and Lithgow LGAs have greater capacity than Blayney to absorb pipeline construction accommodation demands due to the size of the short-term accommodation market in these locations.

The construction phase of the pipeline development will overlap with the Bathurst 1000 event and therefore has some potential to reduce access to accommodation for visitors for approximately one week during October. To minimise the severity of this impact, Regis will, where possible, reduce construction activities during key regional events such as the Bathurst 1000 to ensure workers do not remain in regional short-term accommodation options across these peak demand periods.

33.4.3 Access and amenity impacts

The construction phase of the pipeline development may give rise to temporary localised delays to access across local road networks. A traffic management plan will be prepared as a subplan of the CEMP to manage traffic impacts during construction.

There will be temporary impacts to amenity during the construction of the pipeline development due to temporary and short-term noise and vibration. There will also be short term and minor visual impacts associated with construction.

33.4.4 Property and land use impacts

The focus of the pipeline corridor selection process has been the minimisation of social and environmental effects. The alignment of the pipeline corridor was selected to minimise disruption to land uses, which included aligning with some existing easements and the use of roads and forestry tracks. Prior to the finalisation of alignments in this area, discussions were held with landowners and changes made to the alignment where possible based on their preferences, for example to reduce impacts to existing irrigation infrastructure. The four pumping station facilities have been specifically located to minimise impacts on adjacent or nearby residential properties.

Potential property impacts are considered in Table 33.2.

Table 33.2 Property and land use social impacts relating to the pipeline development

Potential impact	Comment
Change to property access	There may be temporary delays for landowners to access their properties and to the local road network. A traffic management plan will be implemented during the construction phase.
Potential to disrupt agricultural operations for directly affected landowners	Potential impacts on agricultural activities was raised during consultation with affected landholders. Key concerns identified were: • potential disruption to cropping and sowing activities; • the requirement for stock rotation to accommodate trenching activities; • project related traffic movements on station roads; • development of additional access tracks to facilitate pipeline installation; and • there is the potential for secondary impacts such as flow on effects to scheduled agricultural activities, agricultural productivity and income. Regis has committed to the development of tailored Property Management Plans (PMPs) for each impacted property, and the preparation of a Landholder Communication Plan to ensure adequate notification of the construction phase is provided to all directly affected landowners. Depending on the terms of the easement and license agreement with each landowner there are likely to be restrictions to the future land uses within the pipeline corridor, because land uses which may damage the pipeline may not be permitted to occur. Regis has engaged with directly affected landowners in relation to the location of the infrastructure in order to minimise long-term alienation of land and disruption to landowner operations.
Land degradation	During consultation, several landowners raised concern that pipeline corridor rehabilitation activities could lead to land degradation over time with resulting impacts to agricultural operations eg a reduction in the land available for cattle grazing and cropping. There is a potential for the spread of weeds by vehicles and machinery, if proper vehicle washdown procedures are not followed.
Acquisition of easement	The main potential property impacts during operation will be creation of an easement and change in land use. Regis will be required to create and maintain a 6 to 10 m wide permanent pipeline easement which will remain as a cleared landscape to facilitate maintenance during the operational phase. Landowner titles will need to be amended, which will include restrictions on future land uses within the pipeline corridor.

33.4.5 Public safety during construction

Construction sites would be managed in accordance with the requirements of the WorkCover Authority of NSW and the *Work Health and Safety Act 2011* and the *Work Health and Safety Regulation 2011*.

All construction work will be isolated from the general public. There is a greater likelihood of impacts to public health and safety may occur during construction at road and rail crossings as a result of disruption to traffic flow and presence of personnel and machinery.

The construction contractor will ensure that construction sites are secure at all times and would take all possible actions to prevent entry by unauthorised persons.

With respect to construction of the pipeline, trenching activities would generally be undertaken at a rate that allows pipe laying and backfilling of the open trench within the same day. This would minimise the risk to the public and to animal life associated with falling into an uncovered trench. Any trench that is not backfilled at the end of the day would be fenced off. Compliance with these requirements would ensure that construction risks to the general public (and stock) are adequately managed.

33.5 Management and mitigation measures

The following mitigation measures will be implemented to minimise potential social impacts during construction and operation of the pipeline development:

- a Landholder Communication Plan will be developed as part of the property management plan for each property directly impacted by the pipeline development to ensure adequate notification of the construction phase is provided to all directly affected landowners;
- letterbox drops will be carried out prior to the start of noisy construction works as required;
- a formal complaints procedure will be included in the CEMP for the pipeline development and the OEMP for the overall project;
- a Construction Workforce Accommodation Strategy will be prepared in consultation with key stakeholders. The strategy will:
  - demonstrate how the construction phase workforce will be accommodated across the local area;
  - demonstrate how workforce accommodation requirements will be managed during periods of high demand, such as during key regional events including Bathurst 1000;
  - document the approach to informing accommodation providers of predicted pipeline development workforce accommodation demands including anticipated timing; and
    - enable the coordinated placement of the workforce in tourism accommodation throughout the local area.
- Regis will undertake a Local Content Plan to provide a detailed analysis of identified existing local enterprise and the skills/education base of local residents. Wherever possible, the pipeline development supply and workforce requirements will then be 'matched' with existing capabilities in the local community.

33.6 Conclusion

With mitigation, all potential social related risks for the pipeline development were assessed as being of low to moderate, with the moderate risks being the demand for short term accommodation during construction and impacts to Aboriginal cultural and social values. As described in Chapter 28, the risks to cultural heritage values will be effectively managed through the implementation of recommended mitigation measures (primarily salvage prior to disturbance) for the seven cultural heritage sites identified in the corridor. Accommodation demand is likely to be dispersed across the LGAs of Bathurst and Lithgow and to a much lesser extent Blayney. Bathurst and Lithgow LGA will more than likely accommodate the majority of the pipeline development workforce, having a greater capacity than Blayney to absorb pipeline construction accommodation demands.

Chapter 34

Waste

REGIS RESOURCES LTD

34 Waste

34.1 Introduction

Waste will be managed in accordance with the objectives of the POEO Act, the WARR Act*,* the *Protection of the Environment Operations (Waste) Regulation 2014*, the *Waste classification guidelines* (EPA 2014) and the *Waste avoidance and resource recovery strategy 2014-21* (EPA 2014). Regis will apply general waste minimisation principles such as reduce, reuse and recycle to minimise the quantity of waste that must be disposed off-site. No on-site rubbish disposal or landfill is proposed.

The EARs relevant to the pipeline (Table 34.1) require waste management from the construction and operation of the pipeline to be assessed in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014* which provides a regulatory framework for the appropriate reporting, monitoring and management of wastes.

Table 34.1 Waste management related EARs for the pipeline development

Requirement	Where addressed
a tailings risk assessment based on the tailings composition and identification, quantification and classification of the potential waste streams likely to be generated during construction and operation, including and not limited to non-production wastes, reagent materials and cyanide compounds.	34.2 and 34.3
description of the measures to be implemented to store, manage, reuse, recycle and safely dispose of these materials in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014*, including and not limited to operational water by-products, adequate spill detection and clean up systems, suitable locations for disposal or reuse of spoil generated during construction.	34.2 and 34.3

34.2 Waste streams

Actions associated with the pipeline construction and operation will generate a range of waste streams requiring management. Non-production wastes are mostly wastes associated with construction, however general wastes produced during operation will also fall into this category.

A key objective of waste management for the pipeline is to manage waste in accordance with the NSW *Waste avoidance and resource recovery strategy 2014-21*, which outlines a waste management hierarchy, ranging from most preferable to least preferable (avoid and reduce, reuse, recycle, recover, treat, dispose).

The impacts arising from waste during operation of the pipeline are considered to be minor, with most of the waste generated during construction, by volume, being; excess spoil, vegetation and landscape debris, construction materials and general waste. However, liquid wastes from sewage, trench dewatering, washdown and cleaning and testing, and hazardous and regulated wastes, and hydrocarbons would also be waste streams.

Waste generated during the operational phase include wastewater generated by cleaning and dewatering of the pipeline and general waste produced by staff visitations to the pumping station facilities.

As construction activities differ in their level of waste generation, disposal options appropriate to the scale of waste generation will be developed. Table 34.2 identifies waste streams, issues associated with each stream and the preferred management approach.

Table 34.2 Waste streams and management

Waste stream	Issue / storage	Handling strategy / disposal
Spoil material Virgin excavated natural material such as uncontaminated clay, gravel, sand, soil and rock fines.	• Erosion and soil dispersion. • Risk of encountering acid sulfate soil formation. • Risk of encountering contaminated material. • Reduces water penetration and traps heat affecting pipeline rehabilitation	• Topsoil to be re-used for land rehabilitation post construction. • Spoil stockpiled and re-used along the pipeline corridor where possible. Stockpiles to be kept clear of watercourses and away from slopes with suitable sediment fencing applied where necessary. • Excess spoil (virgin excavated natural material (VENM)) to be re-used by Lithgow, Bathurst and Blayney councils on the mine site, or disposed of at appropriate off-site waste management centres. • Soils suspected of being ASS or potentially contaminated are to be characterised and dealt with in accordance with management plans. Refer to chapter 23 for identification and disposal of possible ASS/contaminated soil.
Vegetation and landscape debris Cleared vegetation and landscaping material.	• Destabilise nutrient cycle of soil and vegetation. • Compactivity of soil disturbed. • Low quality aesthetics and visual amenity.	• Vegetation to be mulched and stockpiled to reduce fire hazards and protect soil surface from erosion as part of the sites construction ESCP; mulch can be used as part of the long-term rehabilitation of the pipeline corridor so long as it is appropriately stockpiled and aged prior to use. • The extent of permitted vegetation clearing will be identified prior to construction.
Construction waste Rubble, cement, timber, plywood, scrap metal, bitumen, paint, solvents.	Minimal impacts as wastes will be transported to appropriate facilities as per Waste Management Plan.	• Request suppliers to reduce packaging and collect packaging after unboxing. • Sort, stockpile and transfer waste for recycling. • Sort, stockpile and transfer waste for disposal if not recyclable • Disposal of wastes by licensed contractor at appropriate facilities.
Wastewater from wash down Wastewater from washing down vehicles, equipment and machinery.	Runoff from equipment and machinery containing weeds, sediments, oils and detergents.	• Equipment and machinery washed down in designated area away from waterways. • Provide sump to collect oils, grease and other contaminants. • Provide off site wash down facilities with appropriate wastewater collection and disposal by a suitably licenced contractor.
General waste from staff Food waste, toiletries, office waste, recyclable waste.	• Low quality aesthetics and visual amenity. • Smell and contamination if waste not cleared.	• Provide adequately sized bins in appropriate locations. • Sort waste for composting, recycling and disposal. • Lidded or sealable bins to minimise odour and breeding ground for pests.
Sewage Onsite sewage generated during construction from temporary toilets.	• Odour and poor air quality. • Contamination to the surrounding environments if not serviced or cleaned regularly.	• Mobile toilets and showers to be managed and cleaned through a mobile system contractor. • Sewage to be managed and disposed by licenced contractors.

Table 34.2 Waste streams and management

Waste stream	Issue / storage	Handling strategy / disposal
Trench water Infiltrated groundwater and surface runoff during rainfall events.	Minimal to no impacts on uncontaminated land.	• Allow trench water to evaporate naturally or dispose of in accordance with the CEMP ESC subplan. Options for disposal may be pumping water to sediment dams or tanks for flocculation, pumping to land through filter media through the use of pumps.
Hazardous and regulated wastes Chemicals used during the construction of the pipeline.	• Contamination of soil, air and waterways. • Amounts generated will have negligible impact as minimal quantities will be generated from the project.	• Waste Management Plan to address hazardous waste in accordance with all applicable legislation. • Contain wastes to avoid release into the environment, including use of bunded containers or areas as applicable. • Transport and dispose of hazardous waste to appropriate facilities by licenced contractors.
Hydrocarbon wastes Oils and lubricants used during construction of the pipeline.	Soil and waterway contamination if a spill occur.	• Waste Management Plan to address hydrocarbon wastes in accordance with all applicable legislation. • Use a spill kit on site that is formulated to manage spills. • Contain hydrocarbons to avoid release into the environment including use of bunded containers or areas as applicable. • Transport and dispose of hydrocarbon waste to appropriate facilities by licenced contractors.
Cleaning and testing of pipeline Wash down debris from testing of pipeline and scour water from dewatering. Waste from pigging (cleaning of sediments, algae and other deposits) removed by a scouring pig during routine maintenance	Debris from wash down pipeline and scour water from scour valves dispersed into surrounding land and waterways.	• Provide a retention basin for water collection and disposal under licence. • Pigging waste will be collected and disposed of by an appropriate independent waste contractor.

34.3 Management and mitigation

Regis will prepare waste management sub-plans (WMP) for the CEMP and OEMP. The WMP will describe mitigation measures to ensure waste is reduced, reused or recycled where possible. The follow mitigation measures will be implemented to manage waste:

- waste streams will be classified and managed in accordance with the POEO Act, *Waste Avoidance and Resource Recovery Act 2001* and the *Waste Classification Guidelines* (EPA 2014);
- each waste stream will be appropriately segregated and stored prior to reuse, recycling or disposal;
- designated waste storage bins or areas or bins will be frequently inspected;
- designated waste storage bins and areas will be appropriately sign posted;
- site induction training will include detail of where on site to correctly dispose of each non-production waste stream and mitigation measures to ensure non-production waste is reduced, reused or recycled where possible; and
- waste disposal will be conducted by an independent appropriately licensed contractor.


Chapter 35

Rehabilitation and closure



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35 Rehabilitation and closure

35.1 Introduction

This chapter provides a rehabilitation decommissioning and closure strategy for the pipeline development, including the initial stabilisation works that will occur after construction, and rehabilitation at the end of the project life, when the pipeline development is no longer required for the mine development. It is noted that the strategy presented in this chapter is based on the scenario that the pipeline is not retained for a future use at the end of the mine life. Possible alternative uses will be considered during the detailed closure planning, to be undertaken within 5 years of closure. As described in Section 2.16.3, it is anticipated that the pipeline will remain in the ground at the end of the mine operating period. However, there may be an opportunity for the pipeline infrastructure to continue to provide future public benefit by enhancing water security and supply to the region, subject to obtaining the necessary approvals.

The overarching objective of the rehabilitation strategy is to create a safe, stable, and non-polluting landform that is consistent with agreed post development land uses.

The EAR's specified two requirements relating to rehabilitation and closure, as shown in Table 35.1.

Table 35.1 Rehabilitation related EARs for the pipeline development

Requirement	Where addressed
Key Issues:	This chapter.
Closure, Rehabilitation and Final Landform – including a Rehabilitation and Landscape Management Strategy providing:	The rehabilitation strategy for the mine development is presented in Chapter 22 and Appendix U.
a detailed overview of the final land-use and closure criteria for the development, including both the mine and site and raw water pipeline; and	Section 35.3.3 (post project land use) Section 35.6 (completion criteria)
identification and discussion of opportunities to improve rehabilitation and environmental outcomes for existing disturbed areas within the project site.	Section 35.4

35.2 Rehabilitation and decommissioning objectives

The overriding goal of rehabilitation activities is to ensure land disturbed by the pipeline is rehabilitated to an appropriate standard agreed to in consultation with the relevant landholder representative of surrounding vegetation communities and is compatible with pre-disturbance and surrounding land use.

The rehabilitation objectives for the pipeline include:

- management of soil resources to minimise erosion and conserve soil for future rehabilitation works;
- rehabilitation of disturbed areas to their pre-disturbance condition or better. Forested land will be rehabilitated to its former vegetation community and agricultural land will be rehabilitated to achieve the pre-disturbance land and soil capability class, where possible;
- establishment of a set of indicators and monitoring program to ensure successful rehabilitation; and

- establishment of agreed criteria where rehabilitation is deemed successful by relevant agencies and stakeholders.

The rehabilitation objectives for the various aspects are summarised in Table 35.2.

Table 35.2 Rehabilitation objectives for the pipeline

Aspect	Objective
Pipeline (as a whole)	• Safe, stable and non-polluting • Pre-disturbance landforms are generally re-established
Existing native vegetation and forestry areas	• Establish self-sustaining ecosystems characteristic of the pre-disturbance vegetation communities found along the corridor.
Agricultural land	• Reinstate targeted land and soil capability classes • Rehabilitate grassland areas so that they can support sustainable grazing activities
Watercourse crossings	• Engineered to be hydraulically and geomorphologically stable • Incorporate erosion control measures based on natural channel design principles • Revegetate with suitable riparian species
Surface infrastructure	• To be decommissioned and removed, unless agreed otherwise as part of the detailed closure planning process
Community	• Ensure public safety

35.3 Environmental risk management

Identifying environmental risks associated with rehabilitation and closure is essential for effective closure planning. Key risks during the rehabilitation and closure phases include:

- potential for erosion and sediment impacts on watercourses, resulting from;
  - tunnel erosion within the pipeline trench where dispersive and/or non-cohesive soils are present;
  - watercourse bed and bank erosion when pipeline construction involves trenching through the watercourse; and
  - rill and gully erosion on steeply grading areas.
- not achieving the agreed post mining land and soil capability (LSC) classes on rehabilitated lands;
- weeds; and
- hydrocarbons, chemicals and wastes.

Mitigation measures to ensure the above risks are effectively managed will be documented in the rehabilitation management plan for the pipeline and are likely to include (refer also to section 35.5.4):

- Erosion and sediment control:
  - chemically treating dispersive and magnesic soils excavated from the pipeline trench such that Ca: Mg ratio is >0.5 and exchangeable sodium percentage is less than 4%;

- the segregation of subsoil and topsoil during stripping, excavation and stockpiling; and

- selectively handling and placing the more erodible soils such that they are covered by less erodible soils.

• Weeds will be managed through a series of control measures, including:

  - appropriate weed hygiene for machinery and vehicles during pipeline construction, rehabilitation and operation that may include inspection and wash-down prior to entry to the pipeline corridor, after working in areas of known weed infestation and prior to entry into different properties;

  - herbicide spraying or scalping weeds prior to construction works;

  - rehabilitation inspections to identify potential weed infestations; and

  - identifying and spraying existing weed populations together with ongoing weed spraying over the life of the project.

Further detail on the management of soils and weeds is provided in Chapter 23 (soils) and Chapter 27 (biodiversity).

A detailed rehabilitation risk assessment will be undertaken as part of the development of the Rehabilitation Management Plan for the pipeline. A Trigger Action Response Plan (TARP) will be developed based on the key outcomes from the risk assessment. The TARP will identify key risks or threats to rehabilitation success for the pipeline corridor and will detail the risk treatment measures or contingency measures that will be undertaken to mitigate the identified risks.

The triggers identified in the TARP will be reviewed and updated (if necessary) following implementation of the rehabilitation monitoring programme.

Anticipated contingency measures that will be implemented where rehabilitation monitoring results identify a requirement for maintenance or remedial works include:

• repair of erosion (ie regrading of eroded areas);

• repair of drainage structures and de-silting of sediment control structures;

• supplementary seeding or planting;

• application of fertiliser;

• application of gypsum or lime to control pH and improve soil structure;

• bushfire management activities; and

• implementation of weed and pest control measures.

The effectiveness of the remedial works will be monitored during regular maintenance inspections of the pipeline and remedial measures identified and implemented as necessary.

35.4 Post project land use and LSC class

35.4.1 Existing LSC class

Based on regional scale mapping provided by OEH, the land and soil capability class along the pipeline development is predominantly Class 5 (73 ha) and Class 3 (20 ha), with Class 4 at 14 ha. These LSC classes are typically considered moderately low (Class 5) to high (Class 3) capability land and are generally consistent with livestock grazing with improved pastures with possible regular cultivation in Class 3 land. There are also small areas, along the pipeline development, of the remaining LSC from Class 2 to Class 8.

Figure W.2 in Appendix W shows the spatial distribution of the LSC classes along the pipeline corridor. The LSC class definitions are provided in Table W.4 in Appendix W along with the extent of each class mapped along the pipeline development.

Rehabilitation works will aim to re-establish pre disturbance LSC classes. This will be achieved by selective stripping, excavation, stockpiling, backfilling and re-spreading of soil resources. This is described in further detail in section 35.4.2.

35.4.2 Post project land use

Large areas of the pipeline corridor are non-native vegetation comprised of cleared agricultural land used for grazing and cropping and *Pinus radiata* plantations within state forests.

The native vegetation in the pipeline corridor consists of areas of paddock trees over exotic pasture, open woodlands in the west and forests in the higher altitude of the east. The area of native vegetation cover within the pipeline corridor is 8.51 ha (6.7% of the pipeline corridor), of which the condition state for 2.88 ha is classified as 'good', 0.98 ha is classified as 'moderate' and 4.65 ha is classified as 'poor'. Non-native vegetation covers 83.2 ha of the pipeline corridor.

Rehabilitation of the pipeline corridor will be undertaken in two phases; after completion of construction, and then upon decommissioning of the pipeline at the end of the project life:

- Phase 1 – Initial progressive rehabilitation immediately following construction where disturbed areas will be seeded with cover crop, introduced and/or native grass species to provide erosion protection and re-establish pre-disturbance land use such as grazing and cropping land-uses.

- Phase 2 – Removal and rehabilitation of surface infrastructure such as pump stations and scour valves (unless the pipeline and infrastructure are retained by another party post mining for beneficial re-use), followed by re-establishment of vegetation communities that reflect the original vegetation and/or forestry plantations. Phase 2 cannot be undertaken until the pipeline is no longer being used as deep rooting native and non-native tree species may damage the pipeline.

Agricultural post disturbance land-use will be able to be re-established relatively quickly, although the full capability may not be realised until one to two years post disturbance, to allow pasture species to go through a number of growing cycles and for soil microbiology to re-establish.

Native vegetation within the pipeline corridor generally occurs on privately owned farming land and road reserves. The re-establishment of native vegetation will be undertaken with agreement from the landowners.

Where it is agreed to re-establish native vegetation, local provenance seed will be collected from adjacent areas from the structurally dominant and threatened flora species and seeded using direct seeding techniques appropriate to access limitations, slope steepness and erosion risk.

35.5 Rehabilitation methods

35.5.1 Overview

Regis is committed to the progressive stabilisation and rehabilitation of disturbed areas resulting from the construction of the pipeline and associated infrastructure. As described in section 35.4.2, rehabilitation of the pipeline and associated infrastructure will occur in two phases. Establishment of deep rooting native and forestry species cannot occur during the operational phase of the pipeline as tree roots may damage the structural integrity of the pipeline.

It is likely that areas of existing erosion and land degradation will be encountered during the construction of the pipeline and associated infrastructure. These areas will be stabilised and rehabilitated where they impact on the integrity of the infrastructure and/or the rehabilitation objectives for the pipeline.

Specific rehabilitation methods for the pipeline and associated infrastructure area described below.

35.5.2 Pipeline

i Construction areas outside of creeks and drainage lines

Phase 1 rehabilitation will involve backfilling with ameliorated subsoil (where required) and then compacting the soil using a compaction wheel on an excavator. It is expected that trench backfilling will commence within 24 hours of pipelaying. The subsoil will be backfilled slightly higher than the original depth to allow for settlement. Topsoil will be spread over the subsoil at depths nominated in the soil management plan and contour scarified. The area will then be seeded with cover crop and perennial grass and legume species (subject to landowner agreement) and topsoil ameliorants applied using a broadcast spreader, drill or tyne seeder. Where there is potential for run-off concentration within the corridor, cross banks will be used to divert flow to stable areas outside of the corridor.

Stock will be excluded from the newly seeded areas by making suitable arrangements with the landowner or the installation of a temporary electric fence.

Phase 2 rehabilitation will occur when the water pipeline is no longer required for the mine development. The pipe will remain in the ground so that soil disturbance is minimised. All surface infrastructure such as the pumping station facilities and scour valves will be removed, and any excavations will be backfilled and rehabilitated as per phase 1.

In State Forest Areas, forestry species will be seeded in agreement with the Forestry Corporation of NSW. On privately owned lands, native communities maybe re-established subject to land owner requirements.

ii Construction areas within creeks and drainage lines

During rehabilitation, the management and placement of subsoil and topsoil will be similar to non-creek and drainage area rehabilitation works. However, in some areas it may be necessary to provide additional scour protection over the pipe. At these locations, the pipe will be installed at sufficient depth such that it is below any mobile bed material, such as deep sand or gravel, that is likely to be mobilised during severe floods. Any pipe scour protection measures will be finished flush with the solid bed material and will not extend into the bed load material that is expected to migrate during floods. Excavated bedload load sediment/cobble will then be replaced without substantially changing the bed level or gradient.

Re-directive and natural channel design stabilisation techniques will be used in conjunction with bioengineering techniques instead of traditional resistive hard armours where possible to minimise bed scouring and channel destabilisation.

The bed and banks will be rehabilitated to its natural geomorphology unless the channel is highly degraded and requires additional stabilisation or a permanent light vehicle crossing is required for the life of the pipeline.

More intensive soil stabilisation and revegetation techniques such as coir mesh anchored with 'duck-billed' soil anchors and heavy-duty hydro-mulches are likely to be required.

Disturbed areas will be stabilised with cover crop and perennial grass and legume species. Native species may also be seeded within the bed and banks of creeks and drainage lines to provide erosion protection.

The timing of soil stabilisation works and required C-factor will aim to be in accordance with Table 7.1 Landcom (2004) (Table 35.3).

Table 35.3 Maximum acceptable C-factors at nominated times during works (adapted from Table 7.1 Landcom 2004)

Lands	Maximum C-factor	Remarks
Waterways and other areas subjected to concentrated flows	0.05	Applies after 10 working days from completion of formation and before they are allowed to carry any concentrated flows (Note: a C-factor of 0.05 is equivalent to 70% ground cover)
Stockpiles, post construction	0.10	Applies after 10 working days from completion of formation (Note: a C-factor of 0.10 is achieved with about 60% groundcover)
All lands, including waterways and stockpiles during construction	0.15	Applies after 20 working days of inactivity, even though works might continue later (Note: a C-factor of 0.15 can be achieved in various ways, including with about 50% ground cover).

Cross banks (trafficable diversion berm) will be installed across the pipeline corridor either side of the rehabilitated creek crossing to minimise erosion banks particularly where a permanent light vehicle crossing is required (Figure 35.2).

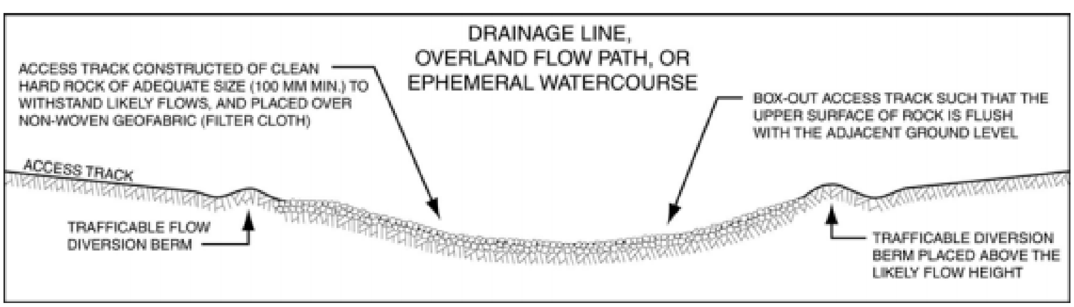

Figure 35.1 Typical light vehicle bed level crossing arrangement (Figure P30 IECA 2014)

35.5.3 Pumping station facilities and other infrastructure areas

The majority of pumping station facilities and other infrastructure areas will have relatively flat gradients other than their outer batters. It is possible that some of the buildings may be retained on private properties for agricultural or other purposes (subject to consultation with relevant landowners at the time); however, for all other areas the infrastructure will be removed, concrete slabs and footings removed and the landform reshaped to the pre-disturbance profile.

Access tracks may be retained for use by use by landowners.

Management of any contaminated areas may include on-site remediation, removal to an appropriately licensed waste disposal facility or encapsulation on-site to prevent the release of contaminants.

Rehabilitation, where required, will accordingly require deep ripping, profiling, application of topsoil and seeding. Drainage will be constructed where necessary.

Power poles associated with the power supply will generally not require the excavation of pads for installation of footings, therefore are not anticipated to require reshaping when they are removed.

35.5.4 Erosion and sediment control

An erosion and sediment control plan will be prepared as part of the CEMP for the pipeline development, in accordance with the Blue Book (Landcom (2004) and DECC (2008)) and IECA (2014).

The identification, management and mitigation of dispersive subsoils within the pipeline trench is important in minimising the potential for tunnel and gully erosion. This will involve:

- topsoil and subsoil testing;
- segregation of subsoil and topsoil during stripping, excavation and stockpiling;
- amelioration of subsoil during excavation and/or stockpiling and/or backfilling to reduce ESP to <4%;
- installation of trench breakers where dispersive and/or non-cohesive soils are present and/or steep gradients are encountered;
- compaction of sub-soil within the trench and allowing for settlement; and
- topsoiling and progressive rehabilitation of disturbed areas.

Erosion and sediment controls will be installed prior to and during disturbance in accordance with Landcom (2004), DECC (2008) and IECA (2014). Sediment controls will be maintained where required until 70% soil surface cover is achieved.

The creek and drainage line crossings will be stabilised and revegetated as a priority using natural channel design and bioengineering techniques.

Revegetation techniques will be varied to suit the erosion hazard of areas undergoing rehabilitation. For example, drill seeding is appropriate for the majority of the pipeline corridor as the slope gradients are very low and significant erosion of the exposed soil awaiting grass germination is unlikely to occur, whereas it is unsuitable for the steep slopes such a creek banks or areas where the gradient is steeper than 33% as the erosion risk is very high and the costs associated with replacing the lost topsoil and seed would be very high.

Disturbed areas will therefore be revegetated as quickly as possible to minimise the risk of erosion. The preference is to use soil surface covers over structural erosion controls; however, some temporary and permanent structural erosion controls such as trafficable cross banks may be required to provide the necessary level of erosion control until vegetation establishes.

35.6 Rehabilitation monitoring and post closure maintenance

Rehabilitation monitoring will be undertaken to monitor progress against the nominated completion criteria. The specific monitoring methods to be applied along the corridor will be determined in the rehabilitation management plan (as part of the CEMP) and will be flexible in consideration of advancing technologies and changes to industry best practice.

Rehabilitation monitoring will inform areas requiring maintenance and identify and address deviations from the expected outcomes. Rehabilitated areas will be assessed against performance indicators (refer to Section 35.7) and regularly (at least on an annual basis) inspected for the following aspects:

- evidence of any erosion or sedimentation;
- success of initial establishment cover;
- natural regeneration of improved pasture;
- weed infestation (primarily noxious weeds, but also where rehabilitation areas are dominated by other weeds);
- integrity of graded banks, diversion drains, waterways and sediment control structures; and
- general stability of the rehabilitation areas.

Where rehabilitation criteria have not been met, maintenance works will be undertaken. This may include the following:

- re-seeding and, where necessary, re-soiling and/or the application of specialised treatments;
- replacement of drainage controls if they are found to be inadequate for their intended purpose, or compromised by vegetation or wildlife; and
- de-silting or repair of sediment control structures.

35.7 Completion criteria

Rehabilitation completion criteria will be used as the basis for assessing when rehabilitation of the corridor is complete. Indicators will be measured against the criteria, and are set for the six phases of rehabilitation, as follows:

- Phase 1 – Decommissioning (ie removal of equipment and infrastructure);
- Phase 2 – Landform Establishment (ie land shaping);
- Phase 3 – Growth Medium Development (ie soil physical and chemical properties);
- Phase 4 – Ecosystem and Land Use Establishment (ie vegetation establishment);

- Phase 5 – Ecosystem and Land Use Sustainability (ie established vegetation is supporting post-pipeline land use); and
- Phase 6 – Land Relinquishment.

Interim rehabilitation criteria for the pipeline development have been developed with the current knowledge of rehabilitation practices and success in similar project environments. The rehabilitation criteria need to demonstrate that the rehabilitation objective has been achieved. Consequently, interim rehabilitation criteria are presented in Tables 35.4, 35.5, 35.6 and 35.7 that address the following outcomes:

- restoration of a safe and stable landform that is non-polluting; and
- reinstate soil profiles and function and create landforms that are compatible with surrounding topography; and reestablishment of landforms that permit grazing, improved pasture, forestry and biodiversity outcomes.

Table 35.4 provides rehabilitation criteria applicable to all proposed post pipeline land uses. Table 35.6 provides rehabilitation criteria applicable to grazing only, Table 35.7 provides rehabilitation criteria application to biodiversity only and Table 35.8 provides rehabilitation criteria to forestry.

Table 35.4 Preliminary rehabilitation performance indicators and completion criteria

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Landform establishment and stability	Landform slope, gradient	Landform suitable for final land use and generally compatible with surrounding topography	Slope angles consistent with design
	Landform function	Landform is functional and indicative of a landscape on a trajectory towards a self-sustaining ecosystem	LFA Stability; LFA Infiltration; LFA Nutrient Cycling; and LFA Landscape Organisation
	Active erosion	Areas of active erosion are limited	Number of rills/gullies; cross-sectional area of rills/gullies; presence/absence of sheet erosion; presence/absence of tunnel erosion.
Growth medium development	Soil chemical and physical properties and amelioration	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH; Electrical Conductivity; Organic Matter; Phosphorus; Nitrate; Cation Exchange Capacity; and Exchangeable Sodium Percentage, Mg and Al
		Soil contaminant levels are suitable for post mine land use	TPH, metals, chemicals

Table 35.5 Grazing rehabilitation performance indicators and completion criteria

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Pasture establishment	Pastures established equivalent to analogue pastures sites	Pastures contains a diversity of species comparable to analogue pastures	Native and introduced pasture species richness
		Number of weeds species and surface area cover ≤ analogue site	Diversity and percentage cover of weed species
Pasture development	Protective ground cover	Ground layer contains protective ground cover and structure comparable to that of the local pasture analogue	Litter cover; foliage cover; annual plants; cryptogam cover; rock; log; bare ground; perennial plant cover (0.5m); total ground cover
	Ground cover diversity	Pasture contains a diversity of species per square metre comparable to that of the local remnant vegetation	Native understorey abundance; exotic understorey abundance
		Number of weeds species and surface area cover ≤ analogue site	Diversity and percentage cover of weed species
Pasture stability	Pasture health	Pasture condition is comparable to that of analogue pastures	Live plants, healthy plants, pest infestation
	Pasture productivity	Pasture productivity equivalent to analogue pastures	Carrying capacity DSE/ha Crude protein % Digestibility % Green/dry matter content

Table 35.6 Biodiversity rehabilitation performance indicators and completion criteria

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Ecosystem establishment	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Diversity of shrubs and juvenile trees; total species richness; native species richness; exotic species richness
	Vegetation density	Vegetation contains a density of species comparable to that of the local remnant vegetation	Density of shrubs and juvenile trees
	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees; shrubs; sub-shrubs; herbs; grasses; reeds; ferns; aquatic

Table 35.6 Biodiversity rehabilitation performance indicators and completion criteria

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Ecosystem development and habitat complexity	Protective ground cover	Ground layer contains protective ground cover and structure comparable to that of the biodiversity analogue	Litter cover; foliage cover; annual plants; cryptogam cover; rock; log; bare ground; perennial plant cover (0.5m); total ground cover
	Ground cover diversity	Vegetation contains a diversity of species per square metre comparable to that of the local remnant vegetation	Native understorey abundance; exotic understorey abundance
		Native ground cover abundance is comparable to that of the local remnant vegetation	Percent ground cover provided by native vegetation
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	Shrubs and juvenile trees 0-0.5 m in height; Shrubs and juvenile trees 0.5-1 m in height; Shrubs and juvenile trees 1-1.5 m in height; Shrubs and juvenile trees 1.5-2 m in height; Shrubs and juvenile trees >2.0 m in height
Ecosystem stability	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5-2 m; foliage cover 2-4 m; foliage cover 4-6 m; foliage cover >6 m
	Tree diversity	Vegetation contains a diversity of maturing tree and shrub species comparable to that of the local remnant vegetation	Tree diversity
	Tree density	Vegetation contains a density of maturing tree and shrub species comparable to that of the local remnant vegetation	Tree density; average diameter at breast height
	Ecosystem health	The vegetation is in a condition comparable to that of the local remnant vegetation	Live trees; healthy trees; medium health; advanced dieback; dead trees; mistletoe; flowers/fruit (trees)

Table 35.7 Forestry rehabilitation performance indicators and completion criteria

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
Ecosystem establishment	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the analogue forestry community	Diversity of shrubs and juvenile trees; total species richness; native species richness; exotic species richness

Table 35.7 Forestry rehabilitation performance indicators and completion criteria

Stage of Development	Aspect or Component	Completion Criteria	Performance Indicators
	Vegetation density	Vegetation contains a density of species comparable to that of the analogue forestry community	Density of shrubs and juvenile trees
	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the analogue forestry community	Trees; shrubs; sub-shrubs; herbs; grasses; reeds; ferns; aquatic
Ecosystem development and habitat complexity	Protective ground cover	Ground layer contains protective ground cover and structure comparable to that of the analogue forestry community	Litter cover; foliage cover; annual plants; cryptogam cover; rock; log; bare ground; perennial plant cover (0.5m); total ground cover
	Ground cover diversity	Vegetation contains a diversity of species per square metre comparable to that of the analogue forestry community	Native understorey abundance; exotic understorey abundance
		Native ground cover abundance is comparable to that of the analogue forestry community	Percent ground cover provided by native vegetation
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the analogue forestry community	Shrubs and juvenile trees 0-0.5 m in height; Shrubs and juvenile trees 0.5-1 m in height; Shrubs and juvenile trees 1-1.5 m in height; Shrubs and juvenile trees 1.5-2 m in height; Shrubs and juvenile trees >2.0 m in height
Ecosystem stability	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the analogue forestry community	Foliage cover 0.5-2 m; foliage cover 2-4 m; foliage cover 4-6 m; foliage cover >6 m
	Tree diversity	Vegetation contains a diversity of maturing tree and shrub species comparable to that of the analogue forestry community	Tree diversity
	Tree density	Vegetation contains a density of maturing tree and shrub species comparable to that of the analogue forestry community	Tree density; average diameter at breast height
	Ecosystem health	The vegetation is in a condition comparable to that of the analogue forestry community	Live trees; healthy trees; medium health; advanced dieback; dead trees; mistletoe; flowers/fruit (trees)

35.8 Conclusion

The proposed disturbed land for the pipeline and associated infrastructure use will be rehabilitated to a range of LSC classes, from LSC class 2 to LSC class 8;. The rehabilitation outcomes will be determined in consultation with the landholder and will generally aim to re-establish the pre-disturbance LSC classes and land-use.

Progress on rehabilitation will be regularly monitored. Final rehabilitation and closure requirements will ultimately be developed as part of a detailed closure plan, which will be produced within five years of closure in consideration of input from key government agencies, relevant stakeholders (including the nearby community) and applicable guidelines and standards at the time.

Part F

Cumulative impacts and commitments


Chapter 36

Economic assessment



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36 Economic assessment

36.1 Introduction

This chapter provides a summary of the results of the economic assessment undertaken of the project, comprising both the mine and pipeline development, by Gillespie Economics (2019). The full report is included in Appendix DD. The economic assessment considers both:

- the efficiency of the project – ie the economic costs and benefits; and
- the impacts of the project – ie the effects that the project will have on local, regional and state economies.

The EARs require the consideration of the economic impacts and benefits of the project. The relevant EARs and where they are addressed is provided in Table 36.1.

Table 36.1 EARs relating to the economic assessment

Requirement	Where addressed?
In particular, the EIS must include: • the reasons why the development should be approved having regard to: – the biophysical, economic and social costs and benefits of the development;	This chapter and the Economic Assessment in Appendix DD consider the economic cost and benefits of the project. The biophysical and social costs and benefits are described throughout the other chapters in Part D and Part E of this EIS.
Socio-Economic – including: • an assessment of the likely economic impacts of the development, paying particular attention to:	
– the significance of the resource	Chapter 39 (project justification)
– economic benefits of the project for the State and region	36.3, 36.4 and Appendix DD
– the demand for the provision of local infrastructure and services; and	Chapter 20 and 33 (social assessment)
– consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services.	Chapter 20 and 33 (social assessment)

36.2 Methodology

The economic assessment was carried out in accordance with relevant standards and guidelines as follows:

- *Guideline for the use of cost benefit analysis in mining and coal seam gas proposals in NSW* (DPE 2015);
- *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (DPE 2018b); and
- *NSW Government Guide to Cost-Benefit Analysis* (NSW Treasury 2017).

Two types of analysis were prepared in accordance with the above guidelines:

- a cost benefit analysis (CBA), which is the primary way that economists evaluate the net benefits of projects and policies, provide economic justification for a project and address the public interest;
- a local effects analysis (LEA), using a methodology developed by the NSW Government (2015), to assess some of the impacts of the project in the locality; specifically the:
  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.

A supplementary LEA, using traditional input-output (IO) analysis, was also carried out by Gillespie Economics to assess the broader economic activity footprint in relation to output, value-added, income and employment.

The economic assessment was based on year by year financial and employment data provided by Regis. This year by year data is commercial-in-confidence but key assumptions are summarised in Table 36.2. It should be noted that the economic costs and benefits are discounted to todays (2019) values. Estimates of net production benefits are not equivalent to estimates of the pre-tax financial net present value of the project due to this difference in timing, exclusion of royalties as a cost and inclusion of the opportunity cost of land and capital equipment.

Table 36.2 Key assumptions underpinning the economic assessment

Item	Assumption
Mining Methods	Conventional load and haul, drill and blast open cut
Resources and Reserves	Mineral Resource Estimate (indicated + inferred) - 68.9Mt@1.04g/t gold for 2.3M ounces Ore Reserve Estimate (probable) - 60.1Mt@1.05g/t gold for 2.0M ounces
Extraction	Up to 8.5 Mt of ore per annum
Processing rate	Up to 7 Mt of ore per annum
Saleable Product	1.7M ounces (averaging 190,000 ounces per annum up to a maximum of 250,000 ounces per annum)
Life of Analysis	17 years comprising: 2 years pre construction 15 years project life
Workforce	*Construction* • Average annual construction workforce 520 FTE in first year (710 FTE at peak) *Operations* • Average annual operational workforce - 260 • Maximum average annual workforce - 320
Gold Price	USD1,320/ounce
AUD:USD Exchange Rate	0.75
Capital Expenditure	Life of project capital expenditure, including sustaining capital and mining fleet- $500M
Average annual operating costs (net of royalties)	AUD159M
Royalties	4% ex-mine value (value less allowable deductions)

36.3 Cost benefit analysis

36.3.1 Overview

CBA is the method used to consider the economic efficiency of proposals by providing a comparison of the present value of aggregate benefits to society, as a result of a project, with the present value of aggregate costs (ie the net benefit). Provided the present value of benefits to society exceed the present value of the costs, a development is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

CBA involves the following steps:

- identification of the base case (or the 'without the project' scenario), which for this project is to not proceed and the continuation of the existing agricultural land use;
- identification of the project and its implications;
- identification and valuation of the incremental benefits and costs;
- consolidation of value estimates using discounting to account for temporal differences;
- application of decision criteria;
- sensitivity testing; and
- consideration of non-quantified benefits and costs.

36.3.2 Identification of benefits and costs

The CBA of mining projects involves a trade-off between:

- the net production benefits of a project to society including royalties, company tax and net producer surplus and any economic benefits to existing landholders, workers, and suppliers; and
- the environmental, social and cultural impacts of the project, including net public infrastructure costs.

Relative to the base case (ie the project not proceeding), the project will generate a number of incremental economic benefits and costs, which are summarised in Table 36.3. The main potential economic benefit is the producer surplus, as well as royalties and company tax payments generated by the project, as well as wage benefits, non-market benefits to employment, economic benefits to existing landholders and benefits to suppliers. The main potential economic costs relate to environmental, social and cultural costs, including any net public infrastructure costs and loss of surpluses to other industries.

Table 36.3 Potential economic benefits and costs of the project

Costs	Benefits
Net environmental, social, cultural and transport related costs	Net production benefits
Net public infrastructure costs	*Royalties*
Loss of surplus to other industries	*Company tax*
	Net producer surplus
	Wage benefits to employment
	Non-market benefits of employment
	Economic benefits to existing landholders
	Economic benefits to suppliers

The estimated costs of the project are described in detail in the economic assessment (refer to Appendix DD), and include:

- the opportunity cost of capital and land;
- the development cost of the project;
- annual operating costs; and
- decommissioning and rehabilitation costs.

The production benefits of the project (including the estimated value of gold, and the residual value of equipment and land at the end of the mine life) and the environmental, social and cultural costs and benefits have also been quantified and are described in detail in Appendix DD. The environmental, social and cultural costs and benefits accounted for include:

- the value of foregone agricultural production in the project area;
- the cost of obtaining surface and groundwater licences;
- noise and visual mitigation measures;
- biodiversity offset related costs;
- cost related to GHG emissions;
- wage benefits;
- non-market value of employment;
- benefits to landholders and suppliers; and
- Net public infrastructure costs.

Importantly, adverse uncompensated environmental, social and cultural impacts of the project have been minimised through project design and mitigation, offset and compensation measures (as described in Chapter 6). Where mitigation measures have been identified, these have been included in the capital costs of the project, as indicated in the results of the CBA presented in Section 36.3.3.

Expert technical investigations, the outcomes of which are described in detail in Part D and Part E of this EIS, indicate that no material impacts are envisaged in relation to air quality, public infrastructure or loss of surplus to other industries. The environmental and social costs borne by the community, relating to greenhouse gas generation and heritage impacts, have been included in the CBA as costs of the project. However, these are minor compared to the estimated net production benefits of the project.

36.3.3 Results

i Global costs and benefits

The present value of costs and benefits of the project, using a 7% discount rate, is provided in Table 36.4. The top half of the table summarises the production costs and benefits of the project, which includes capital and operating costs associated with the mitigation, offset and compensation of environmental and social impacts. The bottom of the table summarises the residual environmental, social and cultural impacts of the project after mitigation, offsetting and compensation. As can be seen, the mitigation, offsetting and compensation costs are a very small proportion of the capital and operating costs of the project and even substantial changes in them would have only modest impacts on the project. The results of sensitivity testing of the overall capital and operating costs is provided in Section 36.3.4.

As shown, the project is estimated to have total net production benefits of $355M (present value at 7% discount rate). Residual environmental, cultural and social impacts of the project are estimated at $23M present value (mainly associated with greenhouse gas emissions and historic heritage impacts). In addition, there are potential employment benefits of $92M. In total, the project is estimated to have net social benefits of between $331M and $423M.

The two numbers presented for the net social benefit of the project relate to employment benefits. In addition to the direct benefit of employment, there may also be spillover effects and externalities to third parties as a result of increasing employment (ie the non-market value of employment). Gillespie Economics (2019) estimates the non-market employment benefits of the project as $60M. The results of the CBA have conservatively been reported without and with employment benefits.

ii National costs and benefits

Not all of the identified net social benefits of the project will accrue to Australia. Regis is approximately 4% foreign owned and hence the net production benefits that accrue to Australia are associated with royalties, company tax, and 96% of residual producer surplus. On this basis, the net production benefits that accrue to Australia are estimated at $347M (present value at 7% discount rate), comprising $47M in royalties, $98M in company tax and $202M in residual producer surplus.

Overall, the project is estimated to have net social benefits to Australia of between $345M and $437M (the latter incorporating the benefits of employment), and hence relative to the “without project” scenario, is desirable and justified from an economic efficiency perspective.

For the project to be questionable from an Australian economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the project that impact Australia, would need to be valued by the community at greater than $347M in present value terms.

From Table 36.4 it can be seen that most of the potential impacts are internalised into the capital and operating costs of the project, borne by Regis, via mitigation, offset or compensation, and hence are incorporated into the estimate of net production benefits. Other quantified impacts to Australia are estimated at $2M, which is significantly less than the estimated $347M net production benefits of the project to Australia.

Table 36.4 Global and national costs and benefits (present value, 7% discount rate)

	Costs	$M	Benefits	$M
Production	Opportunity cost of land	$30	Sale value of gold	$1,759
	Opportunity cost of capital	$1	Residual value of land	$14
	Development costs	$396	Residual value of capital	$8
	Operating costs ex royalties	$986		
	Rehabilitation and decommissioning costs	$14		
	Production Sub-total	***$1,427***		***$1,782***
	Net Production Benefit			**$355 ($347)**
Externalities	Agriculture	Reflected in land costs which are included in opportunity costs of land and development costs	Wage benefits of employment	$32
	Surface water	The cost of water access licences, if required, are included in development costs. No material residual impacts	Non-market benefits of employment	$60
	Groundwater	WAL cost included in development costs. No material residual impacts	Economic benefits to existing landholders	Not quantified
	Air quality	No material impacts	Economic benefits to suppliers	No material impacts
	Noise and vibration	At receiver mitigation costs included in development costs. No material residual impacts		
	Ecology and biodiversity	Some loss of values but offset. Cost of offset included in development costs		
	Aboriginal heritage	32 sites of stone artefacts impacted. Not quantified		
	Historic heritage	$7($2)		
	Transport and traffic	No material impacts. Costs of access upgrade included in development costs		
	Visual amenity	Cost of mitigation measures for impacted properties included in development costs		
	Greenhouse gas	$16 ($0*)		

Table 36.4 Global and national costs and benefits (present value, 7% discount rate)

	Costs	$M	Benefits	$M
	Net public infrastructure costs	No material impacts		
	Loss of surplus to other industries	No material impacts		
	Externality sub-total	***$23 ($2)***		***$92***
NET SOCIAL BENEFITS – including employment benefits				**$423 ($437)**
NET SOCIAL BENEFITS – excluding employment benefits				**$331 ($345)**

Note: totals may have minor discrepancies due to rounding. When impacts accrue globally, the numbers in brackets relates to the level of impact estimated to accrue to Australia

"No material impacts" does not mean that there will be no impacts but impacts are not likely to amount to more than 5% of the quantified net production benefits of the Project (NSW Government, 2012).

*The value is estimated at $0.09M but is rounded down.

iii NSW costs and benefits

The CBA identified a net social benefit to NSW of $141M and $232M, present value at 7% discount rate (the latter including employment benefits), as summarised in Table 36.5. Consequently, as well as resulting in net benefits to Australia, the project would also result in net benefits to the state of NSW.

Provided any unquantified residual environmental, social and cultural impacts of the project that accrue to NSW are less than $141M to $232M, the project can be considered to provide an improvement in economic efficiency, and hence relative to the "without project" scenario, is justified on economic grounds.

Table 36.5 NSW cost benefit analysis results of the project (present values at 7% discount rate)

Costs	Value ($M)	Benefit	Value ($M)
Environmental, social and cultural impacts		***Share of Net Production Benefits***	
Agriculture	Reflected in land costs which are included in opportunity costs of land and development costs	Royalties	$47
Surface water	The cost of water access licences, if required, are included in development costs. No material residual impacts	Company tax	$31
Groundwater	WAL cost included in development costs. No material residual impacts	Net producer surplus**	$65
Air quality	No material impacts*	Contributions not linked to demand	
Noise and vibration	At receiver mitigation costs included in development costs. No material residual impacts	***Sub-total***	***$143***
Ecology and biodiversity	Some loss of values but offset. Cost of offset included in development costs	***Additional benefits***	

Table 36.5 NSW cost benefit analysis results of the project (present values at 7% discount rate)

Costs	Value ($M)	Benefit	Value ($M)
Aboriginal heritage	32 sites of stone artefacts impacted. Not quantified	Wage benefits to employment	$32
Historic heritage	$2	Non-market benefits of employment	$60
Transport and traffic	No material impacts. Costs of access upgrade included in development costs	Economic benefits to existing landholders	
Visual amenity	Cost of mitigation measures for impacted properties included in development costs	Economic benefits to suppliers	
Greenhouse gas	$0***		
Net public infrastructure costs	No material impacts		
Loss of surplus to other industries	No material impacts		
Total	**$2**	***Sub-total***	***$92***
NET SOCIAL BENEFITS – including employment benefits			**$232**
NET SOCIAL BENEFITS – excluding employment benefits			**$141**

Notes:
* "No material impacts" does not mean that there will be no impacts but impacts are not likely to amount to more than 5% of the quantified net production benefits of the Project (NSW Government, 2012).
**It should be noted that this is not equivalent to profit and hence should not be used to infer profitability of the Project. It is a residual amount after royalties and company tax are subtracted from the estimated total producer surplus of the Project. Company tax payable by Regis was estimated based on the Projects projected yearly taxable income. The estimation of taxable income uses accounting principles and is different to the estimation of net production benefits. In particular, taxable income includes the depreciation of capital rather than actual capital costs when they occur.
*** The value for NSW is estimated at $0.03M but is rounded down.
Errors in total are due to rounding.

The costs and benefits of the project to NSW will potentially be distributed among a range of stakeholders as demonstrated in Table 36.6.

Table 36.6 Incidence of NSW costs and benefits

Costs and benefits	Incidence of costs and benefits	Magnitude of impact ($M)
Share of Net Production Benefits		
Royalties	NSW Government and NSW households	$47
Company tax	NSW Government and NSW households	$31
Residual producer surplus	Regis NSW Shareholders	$65
Additional benefits		
Wage benefits to employment	Some of the local and NSW labour force	$32
Non-market benefits of employment	NSW households	$60
Economic benefits to existing landholders	Local landholders who sell land required for project including buffer land	Not quantified

Table 36.6 Incidence of NSW costs and benefits

Costs and benefits	Incidence of costs and benefits	Magnitude of impact ($M)
Economic benefits to suppliers	Regional and State suppliers of inputs to production	Not quantified
Environmental, social and cultural costs*		
Agricultural impacts	Impacted farmers but compensated via purchase	No material residual impact
Surface water	Local surface water users but compensated via purchase of WALs, if required	No material residual impact
Groundwater	Local groundwater users but compensated via purchase of WALs	No material residual impact
Air quality impacts	Adjoining landholders	No properties impacted by exceedances
Noise impacts	Adjoining landholders	Mitigation measures included in capital costs. Potentially impacted by any residual effects
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets
Aboriginal heritage	Aboriginal people and other local and NSW households	Not quantified
Historic heritage impacts	Local and NSW households	$2
Transport and traffic	Local residents	No material impacts. Costs of access upgrade included in development costs
Visual amenity	Adjoining landholders	Mitigation measures included in capital and operating costs. Potentially impacted by any residual effects.
Greenhouse gas impacts	Local and NSW households	$0
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts

Notes:
* NSW regulations require many impacts to be borne by the proponent via mitigation, offset and compensation. Where these measures perfectly mitigate, offset or compensate then no residual impacts occur and all impacts are borne by the proponent. This table identifies who bears residual impacts where mitigation, offset and compensation is imperfect.

It is evident from Table 36.6 that the potential costs and benefits of the project will accrue to different groups within the community. Local residents and adjoining landholders will primarily bear any residual environmental impacts associated with noise and visual amenity. While residual impacts are unlikely to be material from an aggregate CBA perspective, they would accrue to a small group of adjoining and nearby residents. This is considered further in the social impact assessment (refer to Chapter 20).

36.3.4 Sensitivity analysis

A sensitivity analysis of the various assumptions used in the CBA was undertaken for NSW by applying 20% (+ and -) changes to the following variables at 4%, 7% and 10% discount rates:

- opportunity costs of land;
- development costs;
- operating costs;
- value of gold (ie USD price/exchange rate); and
- residual externality costs.

The results of the sensitivity analysis are presented in Table 36.7. As shown, under all scenarios examined, except the unlikely scenario of a 20% decrease in gold price and a 10% discount rate, the project will have positive net social benefits to NSW.

Table 36.7 NSW CBA Sensitivity Testing (Present Value $Millions) (Excluding Employment Benefits)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$206	$141	$93
Increase			
Opportunity cost of land - 20%	$204	$139	$92
Development costs - 20%	$179	$116	$71
Operating costs - 20%	$131	$79	$42
Value of gold - 20%	$351	$257	$187
Externality impacts	$205	$140	$93
	4% Discount Rate	**7% Discount Rate**	**10% Discount Rate**
Decrease			
Opportunity cost of land - 20%	$208	$142	$95
Development costs - 20%	$233	$165	$116
Operating costs or production levels - 20%	$281	$202	$144
Value of gold - 20%	$61	$24	-$1
Externality impacts	$206	$141	$94

The sensitivity analysis indicates that the CBA results are not sensitive to changes in capital costs, opportunity costs of land and capital equipment or environmental costs that have not already been internalised into production costs, such as greenhouse gas and heritage impacts. Since mitigation, offset and compensation costs are a small component (4%) of the capital costs of the project, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results. The analysis is most sensitive to revenue estimates, ie USD price of gold and the AUD:USD exchange rate and operating costs.

In relation to revenue, the estimated revenue from the project in the economic model is based on an assumed gold price over the life of the project of USD1,320 and an AUD:USD exchange rate of 0.75. This is less than the USD gold price at the time of reporting and less than some market forecasts. The assumed exchange rate is also higher than the current rate with forecasts suggesting continuation of a lower rate. Therefore, revenue estimates used in the model are conservative, and the reported net production benefits associated with the project may be considerably higher than estimated.

36.4 Local Effects Analysis

LEA compliments the CBA by translating effects identified at the NSW level to the potential impacts on the communities located near the project area.

For the LEA, the locality was defined as the LGAs of Orange, Blayney, Cabonne and Bathurst, which is the area in which the project is located and is the region considered likely to be the main source of labour and non-labour inputs for the project. It is acknowledged that a small portion of the project (ie the start of the pipeline) is in the Lithgow LGA. Whilst a proportion of the pipeline construction workforce is anticipated to live in Lithgow during the 12 month pipeline development construction period, given the distance of the mine development from the Lithgow LGA, and the workforce policy that Regis is committed to implementing requiring employees to live within a 1hr commute of the mine site, it is anticipated that few benefits and costs will flow to that LGA. Hence Lithgow LGA has not been included in the LEA.

The effects of the project on regional activity were quantified by Gillespie Economics using input – output (IO) analysis, which involves the following two steps:

- construction of an appropriate IO table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each sector of the economy; and
- identification of the initial impact or stimulus of the project (construction and/or operation) in a form that is compatible with the IO equations so that the IO multipliers and flow-on effects can then be estimated (West 1993).

IO analysis identifies the economic activity of a project on the economy in terms of four main indicators:

- *Gross regional output* – the gross value of business turnover.
- *Value-added* – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output. These costs exclude income costs.
- *Income* – the wages paid to employees including imputed wages for self-employed and business owners.
- *Employment* – the number of people employed (including self-employed, full-time and part-time).

The mine development will provide direct employment for an average of 260 people over its operational life. Net impact on local employment will be dependent upon prevailing levels of unemployment and labour force participation rates, as well as the scope for in-migration of labour. The LEA conservatively assumes full regional employment and no in-migration of labour. These are very restrictive assumptions that serve to understate actual project employment benefits to the local area. A summary of the results of the LEA is presented in Table 36.8. The effects under less constraining employment assumptions are assessed via the supplementary LEA (presented in Section 36.5).

Table 36.8 Summary of local effects

Item	Project direct	Project Direct-Local	Net direct effect	Total net effect (with multiplier)
Construction (Peak Year)				
Employment (persons)	520	296	136	337
Net income (Million)			$12	$24
Operation (Average Annual)				
Employment (persons)[1]	260	195	89	263
Net income (Million)			$8	$18
Net non-labour expenditure (M)	$56 Mpa			
Second round and flow-on effects	Refer to Section 6 of the economic assessment (appendix DD)			
Contraction in other sectors	No material impact			
Displaced activities	No material impact			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of impact**		
Agricultural impacts	Farmers whose land is required for the project	Impacted farmers compensated via purchase of land. No material residual impact		
Surface water	Local surface water users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact		
Groundwater	Local groundwater users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact		
Air quality impacts	Adjoining landholders	No properties impacted by exceedances. No material residual impact		
Noise impacts	Adjoining landholders	Impacted by any residual effects after mitigation		
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets		
Aboriginal heritage	Aboriginal people and other local and NSW households	Some loss of values to those who value Aboriginal heritage		
Historic heritage impacts	Local and NSW households	Some loss of values to those who value Historic heritage		
Transport and traffic	Local residents	No material impacts.		
Visual amenity	Adjoining landholders	Impacted by any residual effects after mitigation		

Notes: 1. *This relates to average annual full-time employment in construction sectors of the economy*

Based on the results presented above, the project is estimated to contribute a minimum of 136 net direct local jobs ($12M in income) to existing residents of the region during the peak year of construction and 89 net direct local jobs ($8M in income) annually during operation.

With flow-on effects included, the peak year of construction will contribute up to a total of 337 in regional jobs and $24M in regional income, and the project operation will contribute up to 263 regional jobs and $18M in regional net income.

36.5 Supplementary Local Effects Analysis

The supplementary LEA, using IO analysis, relaxes the restrictive assumptions of the LEA and allows for divergence from full employment, job chains effects and in-migration of labour to the region. Using this approach, the total annual impact of the peak year of construction on the regional economy is estimated at up to:

- $531M in annual direct and indirect regional output or business turnover;
- $218M in annual direct and indirect regional value added;
- $114M in annual direct and indirect household income; and
- 1,289 direct and indirect jobs.

The operation of the mine is estimated to provide the following contribution to the regional economy:

- $492M in annual direct and indirect regional output or business turnover;
- $272M in annual direct and indirect regional value-added;
- $67M in annual direct and indirect household income; and
- 788 direct and indirect jobs.

The breakdown of the contribution of the project during operation to the regional economy is provided in Table 36.9.

It is noted that the actual regional impact of the project operation is likely to lie between that assessed in the LEA and the supplementary LEA.

Table 36.9 Annual regional economic impacts

Item	Direct effect	Production induced	Consumption induced	Total flow-on	Total effect	Adjusted total for non-local hires
OUTPUT ($M)	335	107	55	163	498	**492**
Type 11A Ratio	1.00	0.32	0.17	0.49	1.49	1.47
VALUE ADDED ($M)	196	48	32	79	275	**272**
Type 11A Ratio	1.00	0.24	0.16	0.41	1.41	1.39
INCOME ($M)	30	26	13	39	69	**67**
Type 11A Ratio	1.00	0.87	0.46	1.32	2.32	2.27
EMPL. (No.)	268	312	232	543	811	**788**
Type 11A Ratio	1.00	1.16	0.87	2.03	3.03	2.94

A breakdown of the estimated employment opportunities that are anticipated across various sectors as a result of the project is provided in Table 36.10. The results show that whilst the highest number of jobs will be in the mining sector, this accounts for around 35% of the total direct and indirect jobs that the project will generate, with other sectors such as retail and services also benefiting from increased job generation.

Table 36.10 Sectoral Distribution of Total Regional Employment Impacts of the project

Sector	Average Direct Effects	Production Induced	Consumption Induced	Total
Primary	0	3	5	8
Mining	268	8	0	276
Manufacturing	0	25	9	35
Utilities	0	8	2	10
Wholesale/Retail	0	48	56	104
Accommodation, cafes, restaurants	0	14	33	47
Building/Construction	0	46	4	49
Transport	0	18	7	25
Services	0	141	92	234
Total	**268**	**312**	**208**	**788**

36.6 Conclusion

The project is estimated to bring significant net social benefits to NSW of $141M to $232M (present value at 7% discount rate), the latter being inclusive of employment benefits. Therefore, the project is highly desirable and justified from an economic efficiency perspective.

The key driver of the net social benefits to NSW is revenue (reflecting production levels, the value of gold in USD and the AUD/USD exchange rate). Forecasts suggest that revenue estimates may be conservative in the economic assessment of the project, and hence the estimate of net social benefits may be conservative.

The relative magnitude of net production benefits and residual environmental, cultural and social impacts indicates that even with large changes to the assumed gold price, the net production benefits of the project to NSW are likely to still far outweigh any residual impacts of the project.

At a local level (within the Blayney, Cabonne, Bathurst and Orange LGAs), and based on the conservative assumption of full regional employment and no in-migration of labour, it is estimated that the project will contribute 136 direct local jobs ($12M in income) to residents of the region during the peak year of construction and 89 direct local jobs ($8M in income) annually during operation.

With flow-on effects included, the peak year of construction will contribute up to 337 in regional jobs and $24M in regional income to existing residents, and the project operation will contribute up to 263 regional jobs and $18M in regional net income to existing residents.

Allowing for less conservative employment assumptions (ie less than full employment in the region, job chains effects and in-migration of labour to the region), the project is anticipated to contribute 1,289 direct and indirect jobs during construction, and 788 direct and indirect jobs during operation.

From a national perspective, the net production benefits that are predicted to accrue to Australia as a result of the project are estimated at $347M (present value at 7% discount rate), comprising $47M in royalties, $98M in company tax and $202M in residual producer surplus. When environmental, social and cultural costs are accounted for, the project is estimated to provide net social benefits to Australia of between $345M and $437M (the latter incorporating the benefits of employment) and therefore, as is the case at the state level, is desirable and justified from an economic efficiency perspective.

Chapter 37

Cumulative impact assessment

REGIS RESOURCES LTD

37 Cumulative environmental and social impact assessment

37.1 Introduction

Given the different nature of the two developments that comprise the McPhillamys Gold Project; the mine development and the pipeline development, the impacts of the two are presented separately in this EIS, in Part D and Part E respectively. This chapter presents a summary of the impacts for the entire project, as well as considering the potential for cumulative impacts to arise from the project and other developments in the region.

37.2 Mine and pipeline developments

A summary of the impacts of the mine development, the pipeline development and the two combined, so as to present an impact assessment of the McPhillamys Gold Project in its entirety, is presented in Table 37.1.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
Soil and land resources	The potential impacts on soil resources are: • temporary loss of land during construction and operation of mine infrastructure; • permanent loss of land in the open cut void; and • permanent reduction in productive potential of the land used to store waste rock and some mine infrastructure areas. The change in land and soil capability classes in the mine project area post-mining will be as follows: • a reduction in LSC class 4 by 12 ha; • a reduction in LSC class 5 by 411 ha; • an increase in LSC class 6 by 336 ha; • an increase in LSC class 7 by 17 ha; and • an increase in LSC class 8 by 70 ha (associated with the open cut void).	There will be no permanent change to the LSC class throughout the pipeline corridor, apart from the pumping station facilities and access tracks. The pumping station facilities will occupy a total maximum area of about 1.85 ha.	Given the temporary nature of the pipeline construction and that it is underground, the impacts to soil and land resources as a result of the project will be associated with the mine development, as follows: • a reduction in LSC class 4 by 12 ha; • a reduction in LSC class 5 by 411 ha; • an increase in LSC class 6 by 336 ha; • an increase in LSC class 7 by 17 ha; and • an increase in LSC class 8 by 70 ha (associated with the open cut void).

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
Agricultural resources	There is no BSAL located in the mining lease application area and proposed disturbance area associated with the mine development. Whilst some reduction in LSC class will occur, disturbed areas within the mine project area will be rehabilitated and returned to an agricultural land use, with the exception of the final void. The impacts to agricultural land within the project area will therefore predominantly be temporary. The financial impact to the agricultural industry income of the disturbance footprint is calculated to be a reduction of \$406,193/yr during the mine life and \$95,373/yr upon rehabilitation, which equates to approximately 1% and 0.2%, respectively, of the total \$42.7M of income from agriculture within the Blayney LGA. In relation to water resources, groundwater levels at existing privately-owned bores (that could be used or agricultural uses) will experience little to no change as a result of the mine development and will not trigger the AIP impact criteria for make good requirements.	As noted above, there will be negligible change to the LSC class in the pipeline corridor. Therefore, it is anticipated there will be no permanent impact to agriculture resources within the pipeline corridor.	Given the temporary nature of the pipeline construction and that it is underground within areas currently used for agricultural purposes, the potential impacts to agriculture resources from the project will be associated with the mine development. These impacts will be temporary, except for the final void which will remain a void at the end of the mine life.
Water resources	Numerical modelling and analytical techniques have been used to develop a site water balance for the mine development, investigate potential changes in flood extent, and predict water quantity and quality changes to surface water and groundwater resources. The impacts on surface water and groundwater as a result of the project are predicted to be minimal and impacts to downstream water users are predicted to be	Construction activities are not expected to interfere with groundwater resources or quality as trenching will typically be relatively shallow (1.3— to 2 m) compared to the likely depth of the water table (generally >10 mbgl). It is unlikely then that the work will intercept groundwater aquifers or their flow systems. In addition, major watercourses, such as the Macquarie River, will be underbored.	The impacts to surface and groundwater resources as a result of the project will be associated with the mine development. The impacts associated with the pipeline on water resources will all be effectively avoided and mitigated through management measures during construction. Regis has secured approximately 45% of the required groundwater licence volume for the mine

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
	minor. Key specific impacts are: Surface water: A temporary reduction in the inflow to Carcoar Dam (4%) will occur as a result of construction and operation of the mine. Following mine-closure and rehabilitation, the reduction in flows will be much smaller (0.5% reduction). This level of change is expected to be within the current natural variability in catchment conditions. Upstream of the Trib A confluence in the mine project area, a 15% reduction in baseflow to surface water (ie the Belubula River) in the local area is predicted to occur during and after mining. However, under existing pre-mining conditions baseflow is predicted to contribute only around 5% to the overall surface water flows in this area. Groundwater: As noted above, groundwater levels at existing privately-owned bores will experience little to no change as a result of the mine development and will not trigger the AIP impact criteria for "make good" requirements.	Effective erosion and sediment controls will be implemented throughout construction of the pipeline, in accordance with the Blue Book (Landcom 2004), so as to avoid impacts to surface water resources from sedimentation.	development, with a clear pathway for how the remaining licence volume will be secured to meet extraction requirements. The project will require a surface water entitlement of 24 ML/yr during mining and up to 31 ML/yr at 100 years post mining.
Noise	Construction: Daytime noise levels during the initial six-month construction period are predicted to comply with the relevant noise management levels (NMLs) at all residential receivers, except for R17, at the eastern end of Kings Plains. A maximum level of 51 dB(A) is predicted at R17, which represents an exceedance of the NML by 5 dB. This predicted exceedance is caused by the construction of the new site access from the Mid Western Highway, which is in close proximity to	Construction: The construction noise levels for most activities associated with the pipeline installation have the potential to be above the relevant noise criteria at most receivers in close proximity to the corridor, although for the most part are expected to be only for a short duration (ie either one to two shifts or up to a few days). The noise levels at one receiver (R48 on Pipers Flat Road in Portland) are predicted to exceed the	Given the very different nature of the two developments in terms of spatial distribution and types of activities, there will not be cumulative noise impacts of the mine development and the pipeline development. The construction of the pipeline will be completed within approximately the first year of the project, and noise impacts will move along the pipeline as construction proceeds, only occurring for a short duration.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
	R17 and will be a temporary activity. Operation: 16 residences will be entitled to voluntary noise mitigation measures upon request in Kings Plains due to predicted exceedances of the PNTLs in the first few years of the mine development (year 1 up to year 4). During this time earthworks will be concentrated at the southern end of the mine project area as the southern amenity bund is constructed. Works in the open cut will also be above or just below the surface. These residences are R17, R19, R21, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34 and R38, as shown in Figure 10.11. Importantly, these exceedances will reduce to within 2 dB of the PNTL by Year 4.	highly noise affected level of 75 dB(A). This house is within 50 m of the pipeline alignment. In accordance with the requirements of the ICNG, respite periods may be required for this property. Operations: Operational noise emissions from the pumping station facilities are anticipated to be negligible at adjacent receivers to each site.	The noise impacts of the mine development will occur within the Kings Plains locality, south of the mine project area. Regis have commenced discussions with the properties where exceedances are predicted to occur.
Air quality	Dispersion modelling of four stages over the proposed mine life indicates that predicted concentrations and deposition rates for particulate matter (TSP, PM_{10}, $PM_{2.5}$, dust deposition, metals and metalloids) and gaseous pollutants (NO_2 and HCN) will be below the applicable impact assessment criteria at all neighbouring sensitive receptors (ie privately owned residences), with the exception of one property, for which Regis have negotiated an option to purchase pending development consent. To achieve this, a number of mitigation measures are committed to, including the use of chemical dust suppressants in the water trucks in high traffic areas, and covering the fine ore stockpile and exposed conveyors.	The construction impacts will be limited in time for each location (generally 1-2 days in any one location) during the laying of the pipeline. With the implementation of dust control measures such as water carts, no significant impact on air quality in the vicinity of the pipeline corridor is anticipated.	Similar to noise, there will be no cumulative impacts on sensitive receivers as a result of the mine and pipeline developments. The air quality related impacts from construction of the pipeline will be temporary and will be effectively managed through standard measures used during the construction of linear infrastructure, including the use of water sprays and limiting the exposure of bare ground at any one time. The emissions associated with the mine are all predicted to be within the relevant EPA criteria throughout the mine life.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
Greenhouse gas	GHG emissions from the mine development are predicted to be minimal and make only minor contributions to the total GHG emissions for NSW and Australia. Annual average total GHG emissions (Scope 1, 2 and 3) to be generated by the mine represent approximately 0.095% of total GHG emissions for NSW and 0.023% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2016.	GHG emissions from the pipeline development are also predicted to be minimal and make negligible contributions to the total GHG emissions for NSW and Australia. Annual average (Scope 1, 2 and 3) GHG emissions generated by the pipeline development range from 0.00077% (construction) to 0.00167% (operation) of NSW total GHG emissions and from 0.000019% (construction) to 0.00041% (operation) of Australian total GHG emissions, based on the National Greenhouse Gas Inventory for 2017.	The GHG emissions as a result of the pipeline are so minor that they make negligible contributions to the GHG emission from the project as a whole.
Terrestrial biodiversity	Following all measures to avoid, minimise and mitigate impacts, the mine development will result in the following residual impacts on terrestrial biodiversity: • removal of 132.36 ha of native vegetation and fauna habitat, of which: – 44.22 ha (PCT 1330) represents White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act; – 18.5 ha represents White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the Commonwealth EPBC Act; – 129.3 ha comprises habitat for the Squirrel Glider, listed as Vulnerable under the BC Act listed; and – 75.77 ha comprises habitat for Koala, listed as Vulnerable under the BC Act and EPBC Act. The area of White Box Yellow Box Blakely's Red	Following all measures to avoid, minimise and mitigate impacts, the pipeline development will result in the following residual impacts on terrestrial biodiversity: • removal of 8.51 ha of native vegetation and fauna habitat, of which: – 0.175 ha represents White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act, and will be cleared for construction of pumping station facility No.4. – 0.28 ha represents White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the Commonwealth EPBC Act, associated with construction of pumping station facility No. 4. With about 66.88 ha of the BC Act listed EEC within the study area, the clearing associated with the pipeline represents approximately 1.7% of the	The project will remove 140.87 ha of native vegetation; of which: • 44.395 ha represents White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act; and • 18.78 ha represents White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the Commonwealth EPBC Act. The biodiversity offset credits required to address the residual impacts of the project are: • 6,066 ecosystem credits; and • 5,108 species credits. In relation to the Commonwealth EPBC Act, the mine development component of the project has been declared a controlled action by the Federal DoEE. The pipeline, which is not likely to significantly impact matters of National Environmental Significance, does not form part of

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
	Gum Woodland to be cleared by the mine development represents a 3.9% reduction in this vegetation community listed under the BC Act, and a reduction in 1.6% ha of White Box Yellow Box Blakely's Red Gum Woodland CEEC listed under the EPBC Act, within a 5 km buffer of the project area. These impacts will be compensated through the implementation of the project's biodiversity offset strategy. The following credits will be required: • 5,927 ecosystem credits; • 1,970 species credit for the Koala; and • 2,845 species credit for the Squirrel Glider.	known EEC within the study area being directly impacted and 0.3% being permanently cleared. This is approximately 33.3 ha of the CEEC in the study area. Therefore, clearing of this CEEC for construction of the pipeline represents a 0.8 % removal of the CEEC in the study area. The following credits will be required: • 139 ecosystem credits; and • 293 species credits. The total species credits required include credits for the Eastern Pygmy-possum, Southern Myotis, Barking Owl, Powerful Owl, Purple Copper Butterfly, Squirrel Glider, Brush-tailed Phascogale, Silky Swainson-pea, Austral Toadflax and Masked Owl.	the controlled action.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
Aquatic ecology	Aquatic habitat is highly disturbed across the mine project area. Notwithstanding, the majority of surveyed sites across the upper Belubula River and associated tributaries are still classified as Type 1 highly sensitive key fish habitat (KFH) due to the presence of aquatic habitat features such as instream aquatic vegetation and in-channel debris. The key findings of the impact assessment in relation to the aquatic environment are: • KFH - The mine development will remove key fish habitat associated with the Belubula River within the disturbance footprint. Approximately 1.8 km of Type 1-highly sensitive key fish habitat and approximately 0.4 km of Type 3-minimally sensitive key fish habitat is within the mine disturbance footprint. • Threatened species: Aquatic habitat in the mine project area is unlikely to support threatened species habitat, including habitat to support breeding or migration, due to the low level of connectivity between pools and the highly disturbed condition of the aquatic environment. • Streamflow: The level of change in streamflow downstream of the mine project area is	The pipeline corridor crosses or runs along the banks of 112 watercourses. Twenty-six of these are mapped as key fish habitat by DPI Fisheries' predictive mapping. Two threatened fish species are predicted to occur within the pipeline corridor; the Macquarie Perch and Purple-spotted Gudgeon. The key findings of the impact assessment in relation to the aquatic environment are: • KFH: Impacts to KFH and threatened fish distribution in the Macquarie River and Queen Charlottes Creek will be avoided by underboring rather than trenching. • Threatened species: Within the corridor, Macquarie Perch is only known from the Macquarie River. This crossing will be underbored, meaning there is no potential impact on this species as a result of the pipeline development. The 7-part test completed for the Purple Spotted Gudgeon concluded there will no significant impact on this species.	The potential impacts as a result of the pipeline construction on aquatic ecology, and in particularly threatened species and KFH, will be effectively avoided and/or mitigated through the underboring of significant watercourses and the implementation of mitigation measures, including the maintenance of fish passage and implementation of erosion and sediment controls during the temporary earthworks. The residual impacts of the project on aquatic ecology will therefore be associated with the mine development, which includes the loss of KFH in the disturbance footprint. Notably however, this habitat is highly disturbed and has a low level of connectivity between pools. An aquatic ecology offset strategy will be prepared and implemented to offset the loss of KFH in the mine disturbance footprint, so that there is a net gain in aquatic biodiversity outcomes of the mine development.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
	expected to be minor in comparison with the natural variability in catchment conditions and accordingly is not expected to have a measurable impact on aquatic habitats downstream from the project area. • Water quality: even without the robust TSF design and seepage management system in place, any seepage that could migrate through the hydrostatic unit and discharge to the Belubula River will have concentrations below the observed baseline surface water quality concentrations, ANZECC (2000) livestock drinking water criteria and ANZECC (2000) 80% protection level for freshwater aquatic ecosystem guideline values. Therefore, no water quality impacts on downstream aquatic environments arising from seepage from the TSF are predicted.		
Aboriginal heritage	Up to 33 identified Aboriginal cultural heritage sites may be impacted by the mine development. 23 of these sites are within the direct disturbance footprint and will be salvaged, in consultation with the RAPS, prior to disturbance. A further 10 sites are within the buffer areas around the direct footprint, which together form the anticipated overall disturbance footprint of the project and will therefore likely be subjected to some form of impact.	Seven Aboriginal cultural heritage sites have been identified within the pipeline corridor and will be salvaged, in consultation with the RAPS, prior to disturbance.	A total of 40 Aboriginal cultural heritage sites are within the disturbance footprint of the project. All sites have been assessed as being of low archaeological/scientific, aesthetic and historical significance. The sites within the mine project area are considered to be of moderate cultural significance, and high cultural significance along the pipeline route. The 40 sites will be salvaged prior to surface disturbance occurring.
Historic	Within the mine project area there are:	No listed historic heritage items are within the	The pipeline development will not impact upon

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
heritage	• no listed historic heritage items; • 7 sites deemed to be of local significance in the direct disturbance footprint of the mine development; • 4 sites also deemed to be locally significant were found within buffer areas around the direct disturbance footprint, and therefore maybe subjected to some level of disturbance; and • 1 site of potentially higher significance (Hallwood farm complex) pending further research, was also identified in the direct footprint of the mine development. Landskape (2019) concluded that the disturbance to the sites in the project area would not greatly impact the historical heritage value of the project area or region or cause cumulative impact.	pipeline corridor. Two locally significant listed items are directly adjacent to the pipeline corridor: • *Leeholme Homestead and outbuildings* listed on the Bathurst Regional LEP; and • *Portland General Cemetery* listed on the Lithgow LEP. The pipeline corridor does not extend over the curtilage of either of these historic heritage items. No additional historical heritage items were located during the field survey within or adjacent to the pipeline corridor.	any historic heritage items. The impacts of the project on historic heritage items will therefore be confined to the mine development. No listed sites will be impacted.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
Traffic and transport	Mine development-related traffic will result in a minor increase to traffic volumes on the surrounding road network; however, the impacted roads have sufficient capacity to cater for the combined background traffic and project-related traffic over the 15-year project life. All vehicles will access the mine site via the new access road, which will be designed in accordance with the relevant Austroads guideline to safely accommodate project-related traffic volumes.	Construction related traffic generated during construction of the pipeline development will not have a significant impact on the operation or capacity of key regional, urban, local or unsealed roads and intersections providing access to each of the pipeline development construction sites. The light vehicle generation is considered very moderate, estimated up to 30 vehicle trips (including minibuses) per day with heavy vehicle movements being on average 32 movements per day. All construction related vehicles will use dedicated construction routes between the individual pipeline development construction sites and the regional road network. Key regional roads will be underbored to avoid any impact to traffic using these roads. Queuing and delays may be associated with partial road closures to accommodate trenched road crossings; however, impacts will be limited in any one location up to two days.	No significant impacts as a result of the project are anticipated on the local or regional road network, during both construction and operation. A new intersection will be constructed on the Mid Western Highway, in accordance with the relevant Austroads standards, to enable safe site access to the mine development for its operational life. A Construction Traffic Management Plan will be prepared prior to construction of the pipeline, which will identify management strategies to be adopted during the pipeline construction to effectively manage traffic during construction so as to avoid impacts on the road network.
Visual amenity	There will be significant visual impacts to sensitive receptors in Kings Plains and other rural residences to the south of the mine project area, as well as to vehicles travelling along the Mid Western Highway, up to Year 4 of the mine development when construction and progressive rehabilitation of the southern amenity bund will be complete. A number of rural residences to the east and west will also experience high levels of visual impact during the initial stages of the mine	The pipeline development will not have significant visual impacts along the pipeline corridor. Construction impacts will be temporary in nature and will move progressively along the pipeline corridor. Once constructed, the majority of the pipeline development is below ground, with only the pumping station facilities, pressure reducing system and valves visible above ground during the operational phase. Pumping station facilities No.1,	Due to the spatial distribution of surface infrastructure associated with the mine and pipeline developments, there will be no cumulative visual amenity related impacts of the two. The surface infrastructure associated with the pipeline is limited to the pumping station facilities and pressure reducing system, and these will be in areas with a high visual absorption capacity primarily due to existing vegetation.

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
	development. Following completion of a number of on-site mitigation treatments and rehabilitation establishment, visual effects will be reduced but will remain moderate to high for some receptors over the life of the mine where there are direct views onto operational components. This reduction will be significant in the long term as the new post mining landforms become integrated with surrounding rural landscape character via micro-topographic design and careful rehabilitation tree planting patterns.	No.2 and No.3 are located on existing mine and infrastructure sites which have a high visual absorption capacity. Pumping station facility No.4 near Bathurst Bike Park will be visible from public viewpoints in the area; however, it is located within existing screening vegetation.	The residual amenity impacts as a result of the project will therefore be associated with the mine development. A number of residences in Kings Plains in particular will experience a significant impact, up until around Year 4 while the southern amenity bund and pit amenity bund are being constructed and rehabilitated. Once complete, these bunds will effectively shield views of the active mine from Kings Plains. Some residents to the east and west of the mine project area will also experience some change in view, although these residences are at a greater distance from the mine than those in Kings Plains.
Social	The mine development will result in benefits to the local and regional communities, as well as resulting in a number of social impacts. The most significant social impacts predicted to occur will accrue to residents in closest proximity to the mine project area, particularly within the settlement of Kings Plains. The potential significant opportunities associated with the mine development will accrue largely to the broader Blayney LGA. The most significant social impact of the mine development on residents close to the project area will be elevated noise levels, particularly during the few years (up to Year 4) prior to the completion of the southern and pit amenity bunds, and a change in the landscape due to the construction of the waste rock emplacement and the removal of the top of McPhillamys Hill as the	The pipeline development will require a peak construction workforce of 120 people. Due to the generally specialised skills required for the construction it is anticipated that the majority of the construction workforce for the pipeline development will be non local hires. The pipeline development will generate demand for an estimated 100 beds of short-term accommodation during the 12 month construction phase. Multiple workfronts will operate at the same time for the pipeline development. Hence accommodation demand is likely to be dispersed across the LGAs of Bathurst and Lithgow and to a much lesser extent Blayney. More than likely Bathurst and Lithgow LGA will accommodate the majority of the pipeline	The total number of jobs to be generated by the project will be as follows: • <u>Construction</u>: estimated peak workforce during Year 1 of approximately 710 FTE employees and contractors, of which around 120 FTE will construct the pipeline development. • <u>Operation</u>: an average workforce of around 260 FTE employees will be required during the 10 year operational mine life, peaking at approximately 320 FTEs in around years four and five of the project. The social impacts and benefits associated with the pipeline construction will be temporary and predominately confined to the one year it will take to construct. The social impacts of the project are therefore most significantly related to the mine

Table 37.1 Combined impact assessment of the mine development and pipeline development

Aspect	Mine development	Pipeline development	Combined – the project
	open cut is mined. Once constructed, the southern amenity bund will effectively shield residences to the south from views of the active mine and from exceedances of noise criteria. The economic impact assessment (refer to Appendix DD) found that the total annual impact of the peak year of construction on the regional11 economy is estimated at up to: • $531 M in annual direct and indirect regional output or business turnover; • $218 M in annual direct and indirect regional value added; • $114 M in annual direct and indirect household income; and • 1,289 direct and indirect jobs.	development workforce.	development. The mine development will provide substantial direct and indirect employment opportunities, which will in turn provide a significant boost to the regional economy. The Blayney LGA in particular will benefit from investment in community infrastructure and services made possible through the a VPA, investment in education and training as Regis seeks to build a local skill base to support labour supply for the project, project procurement spend as Regis is committed to supporting local businesses to participate in the project procurement process, and direct and indirect population growth.

[11] The regional area defined in the *Economic Impact Assessment* (Gillespie Economics, 2019) (Appendix DD) is the combined area of the LGAs of Blayney, Bathurst, Cabonne and Orange. This is different to the Local Area considered in the SIA which is defined as the combined area of the LGAs of Blayney, Bathurst, Cabonne, Cowra and Orange. Further, the Region in the SIA is defined as the Central West Region of NSW.

37.3 Other developments and land uses

A number of other extractive industry/industrial developments occur in the region around the mine project area, as follows:

- Cadia Valley Operations (CVO) - approximately 26 km west of the mine project area.
- A number of small quarries off the Mid Western Highway between the project area and Bathurst.
- East Guyong quarry - approximately 10 km north-west from the proposed McPhillamys open cut.
- Shadforth quarry - approximately 15 km north-west from the proposed McPhillamys open cut.
- Cow Flat Quarry - a limestone quarry approximately 21 km south-east of the McPhillamys mine project area. The MLs for this quarry are held by Omya Australia Pty Limited.
- The Blayney Industrial Estate – approximately 6 km south-west of the mine project area.
- The CVO dewatering plant - approximately 6 kms south-west from the mine project area.

The CVO dewatering facility is used for dewatering gold/copper concentrate from Cadia which is then transported by rail to the eastern seaboard. The distance between McPhillamys and CVO dewatering facility together with the different ore processing and transport methods will not result in any cumulative impacts.

The potential for cumulative impacts from the McPhillamys Gold Project with other major developments in the region is considered in Table 37.2.

Table 37.2 Potential cumulative impacts

Aspect	Potential cumulative impacts with other developments
Social impacts	
Labour draw – potential short-term labour draw from the mining and non-mining sector impacts on productivity	The SIA (Hansen Bailey 2019) found that during construction, the project may lead to competition for construction labour and skills both locally and regionally and contribute to a greater influx of non-local hires that will temporarily affect the population gender balance and community character. These impacts will require careful monitoring in the lead up to and throughout the project's construction period. The temporary increase in labour demand resulting from the project will also drive significant demand for temporary construction labour. Relevant to this is Cadia Valley Operations (CVO), which is the other large mining operation in the region, approximately 27 km west of the mine project area. Existing operations include the underground mining of gold and copper-gold concentrate as part of the Cadia East Project. Newcrest has recently (2018) approved the progression of the Cadia Expansion Pre-Feasibility Study (PFS) to the Feasibility Phase. The feasibility study is due for completion in the first half of financial year (FY) 2020. Based on available information, the SIA considered it possible the project may commence construction within a similar timeframe to future work proposed at CVO. The size of the workforce associated with future construction work at CVO is unknown; however, given the nature of the work the workforce is anticipated to be sizeable. As reported in the SIA, during SIA consultation a few local businesses cited a number of negative impacts that arose due to labour draw during the construction phase of the Cadia East Project. Any significant increase in labour demand in the Blayney LGA has the potential to result in labour draw from the non-mining sector, eg agriculture, technical and trade services, reducing productivity and impacting service delivery. This is because Blayney has a small pool of labour and a very small pool of unemployed labour. Regis will work with Newcrest (and other relevant stakeholders) to coordinate activities and workforce management programs that minimise the impact of the temporary workforce on the community of Blayney.

Table 37.2 Potential cumulative impacts

Aspect	Potential cumulative impacts with other developments
Housing and short-term accommodation	It is likely that Newcrest would source a large proportion of its construction personnel from outside the local area from broader NSW and potentially other states (based on the experienced demand generated by the Cadia East Project). Assuming this is the case, the majority of incoming construction personnel associated with CVO would seek to reside as close as possible to these activities, likely in Orange and to a lesser extent Blayney. Given the relatively small supply of short-term accommodation options in Blayney LGA, and the anticipated workforce accommodation demands associated with the mine development, any additional, even small increase in demand for short-term accommodation on top of project related demand, is likely to have a cumulative impact on: • Short-term accommodation supply and access for the non-mining sector e.g. tourism industry; and • The cost of rental accommodation in Blayney LGA. In relation to short-term accommodation, the SIA found that the project workforce has the potential to take up all available short-term accommodation in the Blayney LGA during the construction phase of the project. Consequently, it is almost certain that if the construction phase of the project aligns with future construction phases at CVO, then the combined workforce accommodation demand will have a cumulative impact on short-term accommodation supply in the Blayney LGA. This is likely to result in the displacement of the non-mining sector, including tourists from any short-term accommodation options in the Blayney LGA. There are numerous events that occur in Blayney LGA and neighbouring Orange and Bathurst LGAs that draw large numbers of tourists to the Central West Region during the year. Any sustained reduction in the availability of short-term accommodation during these key events has the potential to impact event patronage. As described in Chapter 20, prior to commencement of construction Regis will develop a workforce accommodation and management framework address the predicted impacts of the construction phase workforce on housing and short-term accommodation supply in the Blayney LGA.
Services and facilities	The potential cumulative increase in the temporary population in Blayney may also give rise to an increase in demand for medical services, broader health services and emergency services. There is potential for cumulative impacts on health services (i.e. demand for GPs and hospitals) and emergency services, which will need to be monitored.

Table 37.2 Potential cumulative impacts

Aspect	Potential cumulative impacts with other developments
Environmental Impacts	
Reduced productivity in the agricultural industry	The mine disturbance area accounts for less than 1% of the land currently used for agriculture across the Blayney LGA. The main impact of the mine development on agricultural resources will be the removal of grazing livestock from the disturbance footprint during the life of the project. The AIS estimated that the carrying capacity of the mine project area will be reduced by 10,064 dse during the life of the mine. This is equivalent to a reduction in total income of $406,202/pa. This level of reduction in output was modelled in the Economic Impact Assessment (Appendix DD) using the Sheep, Grains, Beef and Dairy Cattle sector of the input-output model of the regional economy. The magnitude of the reduction in income was found to be very small and inconsequential to the regional economy and agricultural support industries. As such, the mine development is expected to have minimal cumulative impact on agricultural productivity in the Blayney LGA.
Noise	The closest mining operation to the mine project area is CVO. However, CVO is approximately 26 km from the McPhillamys Gold Project, and therefore given this significant distance, there will be no cumulative noise related impacts on any sensitive receptors as a result of these two mining operations. There are a number of smaller quarry operations in the region, as described above this table, generally approximately 10-15 km from the mine project area. Given the small scale of these quarries and the distance from the mine project area, no cumulative noise impacts as a result of the McPhillamys Gold Project and these quarries will occur.
Air quality	Similar to noise, given the distance between the mine project area and other industrial/extractive industries in the area, there will be no cumulative related air quality impacts on sensitive receptors. This was confirmed by the results of the air quality assessment, which found that predicted cumulative concentrations and deposition (ie from the mine and inclusive of background concentrations) for all pollutants and averaging periods will be below the applicable NSW EPA assessment criteria (refer to Chapter 11) .
Water resources	The groundwater model predictions (Chapter 9) indicate that groundwater levels at existing privately-owned bores will experience little to no change as a result of the project. The project will therefore not contribute to cumulative impacts on groundwater extracted from bores in the region. Construction and operation of the mine will result in a reduction in the inflow to Carcoar Dam of 4%, which represents a small change in flow.
GHG	The annual average total GHG emissions (Scope 1, 2 and 3) to be generated by the mine represent approximately 0.095% of total GHG emissions for NSW and 0.023% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2016. The mine will therefore not significantly contribute to the cumulative GHG emissions from NSW or Australia.

Table 37.2 Potential cumulative impacts

Aspect	Potential cumulative impacts with other developments
Biodiversity	The area of White Box Yellow Box Blakely's Red Gum Woodland to be cleared by the mine development represents a 3.9% reduction in this vegetation community listed under the BC Act, and a reduction in 1.6% ha of White Box Yellow Box Blakely's Red Gum Woodland CEEC listed under the EPBC Act, within a 5 km buffer of the project area. The pipeline development will clear a further 0.175 ha of White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act, representing 1.7% of the known EEC within the study area. In addition, 0.28 ha of the federally listed White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands CEEC listed under the EPBC Act, will be cleared, representing a 0.8 % removal of the CEEC in the study area.
Aboriginal heritage	A total of 40 Aboriginal cultural heritage sites are within the disturbance footprint of the project. Landskape (2019) concluded that disturbance to these sites will not greatly impact the Aboriginal heritage value of the mine project area or region or cause cumulative impact, considering the assessed significance level and the implementation of management measures; primarily comprising salvage and fencing of sites identified but not to be disturbed.
Historic heritage	The project will not directly impact on any listed historic heritage items and will therefore not contribute to cumulative impacts on historic heritage in the region. Four items deemed to be of local significance have been identified within the mine direct disturbance development footprint. No historic heritage items will be directly impacted by the pipeline.
Traffic and transport	No significant impacts as a result of the project are anticipated on the local or regional road network, during both construction and operation. The traffic assessment of the mine development concluded that the roads to be used by mine-related traffic will have sufficient capacity to cater for the combined background traffic and project-related traffic over the 15-year project life.
Visual amenity	The Visual Impact Assessment (VPA 2019, refer to Appendix S) noted that in relation to cumulative visual impacts, of significance is the overall high visual integrity of the regional landscapes around the project area. Existing developments, such as CVO and the few small quarries scattered around the region, are unlikely to be seen in any one sitting except from elevated locations such as the Church Hill Rotary Lookout in Blayney. As a result, though the McPhillamys Gold Project is a moderate scale mining project and will create changes to the landscape over time, it is unlikely that multiple developments will be in the same view at any one time.

37.4 Conclusion

As is evident in the summary presented in Table 37.1, many of the impacts of the mine development and the pipeline development will not combine to create a cumulative impact on any particular sensitive receiver, due predominantly to the different spatial distribution of the two, the temporary nature of the impacts associated with the pipeline construction and the fact that the pipeline will be constructed underground.

The two components of the project will result in combined impacts to biodiversity in the region, which will be mitigated through an offset strategy that will be developed to offset the loss of native vegetation associated with both the mine and pipeline developments.

Due predominantly to the limited other industrial and extractive industry developments in the region, the project will not result in significant cumulative impacts with other developments on surrounding landuses and sensitive receptors.


Chapter 38

Summary of commitments



REGIS RESOURCES LTD

38 Summary of commitments

38.1 Introduction

This chapter provides a consolidated summary of the commitments made to manage, mitigate and/or monitor impacts during the construction and operation of the project; comprising both the mine development and the pipeline development.

38.2 Environmental management system

Environmental aspects of the project will be managed under an environmental management system (EMS), which will be designed in accordance with the principles of continuous improvement and will be generally based on the Plan, Do, Check, Review cycle, which forms the basis of common international EMS standards (including ISO14001), as follows:

- Plan – identify what is required;
- Do – implement the activities;
- Check – monitor performance through checking and corrective action; and
- Review – evaluate the suitability, adequacy and effectiveness of the system through management review.

Key components of the EMS will include an environmental policy, an environmental risk register, objectives and targets, and a series of management plans and procedures. The EMS will provide a framework and tools so that the project's development consent conditions, along with other relevant statutory obligations, are implemented and complied with.

The EMS will contain:

- two construction environmental management plans (CEMP); one for the mine development and one for the pipeline development; and
- an operational environmental management plan (OEMP). The OEMP will cover both the mine and the pipeline development.

Management plans described in the CEMPs and OEMP will be prepared by suitably qualified persons and in consultation with relevant government agencies where deemed necessary. The CEMPs and OEMP will be prepared to be consistent with the relevant conditions of development consent and statutory obligations. Further detail on the content of these plans is provided below.

38.2.1 Construction Environmental Management Plan

Separate CEMPs will be prepared for the mine development and the pipeline development, given the different nature of works for each component.

Both CEMPs will provide a framework for the management of potential material construction impacts identified in this EIS, including:

- soils and land resources (including erosion and sedimentation);

- water;
- terrestrial and aquatic biodiversity;
- noise and vibration;
- air quality;
- traffic;
- bushfire;
- Aboriginal heritage; and
- historic heritage.

The CEMP will describe the processes and procedures for the management of these specific environmental aspects and mitigation of impacts, as well as any specific monitoring and construction rehabilitation measures to be undertaken.

The CEMP will also contain provisions for site-specific training and induction of construction personnel so that they are made aware of the requirements in the CEMP that are relevant to their respective work activities.

38.2.2 Operational Environmental Management Plan

The OEMP will contain the impact-specific management measures to be implemented during operations, including timeframes and responsibilities. The OEMP will contain a number of sub-plans, which are anticipated to include:

- water management plan, comprising:
  - a surface water management plan, including an erosion and sediment control plan; and
  - a groundwater management plan;
- biodiversity management plan;
- noise, vibration and blasting management plan;
- air quality management plan;
- traffic management plan;
- rehabilitation management plan;
- pest and weed management plan;
- bushfire management plan;
- hazardous materials management plan;
- social impact management plan including a:

- stakeholder engagement plan;
- corporate volunteer strategy;
- local content plan;
- Indigenous participation plan;
- recruitment and training strategy;

- Aboriginal cultural heritage management plan;
- historic heritage management plan; and
- waste management plan.

These individual management plans that support the overarching OEMP will describe the processes and procedures for the management of specific environmental aspects and mitigation of impacts, as well as any specific monitoring and construction rehabilitation measures to be undertaken.

The OEMP will also contain provisions for site-specific training and induction of employees and relevant contractors so that they are made aware of the applicable requirements to their respective work activities.

38.3 Summary of commitments - mine development

A summary of the proposed mitigation, management and monitoring measures for the mine development is presented in table 38.1.

Table 38.1 Summary of commitments - mine development

Soils
• During construction, erosion and sediment controls, such as sediment dams, will be constructed generally in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1 4th Edition* (Landcom 2004) and *Managing Urban Stormwater Volume 2E: Mines and Quarries* (DECC 2008). • Disturbance areas will generally be stripped to the depth nominated in Table 17 of the *Land and Soil Capability Assessment* (SSM 2019a, Appendix H of the EIS), except for soil stockpiling areas and areas of minimal disturbance. • Topsoil and subsoil will be stripped, stockpiled and stored in accordance with the procedures outlined in the CEMP. This will include limiting the height of topsoil stockpiles to approximately 3 m and subsoil stockpiles to around 4 m. • During rehabilitation works, subsoil and topsoil will be re-applied to achieve the land and soil capability classes specified in Chapter 7 and illustrated in Figure 7.7. • Work in areas mapped as a low potential for naturally occurring asbestos will be carried out in accordance with Regis' naturally occurring asbestos procedure.
Water Resources
Water management plan
• Two main water management plans (WMPs) will be developed; one for construction phase (CWMP) and one for the operational phase (OWMP).

Table 38.1 Summary of commitments - mine development

- The WMPs will include details of:
  - the surface water and groundwater monitoring program, including the existing monitoring network;
  - monitoring frequency;
  - water quality constituents;
  - physical water takes and pumping volumes between water storage structures (including the open cut mine);
  - trigger levels for water quality parameters to assist in early identification of water quality trends (including TSF seepage migration);
  - a trigger action response plan;
  - an erosion and sediment control plan;
  - groundwater quality performance and early warning triggers based on statistical analysis of the reported ranges in baseline concentrations of identified analytes of concern (eg pH, salinity concentrations and concentrations of other analytes such as, CN (WAD and Total), S, SO_4, Se, and Al);
  - groundwater 'quantity' (head) performance based on a combination of baseline head data for selected monitoring bores as well as comparison of observed and model predicted heads for different stages of mine development (operational and closure);
  - requirements for storing fuels and other potential contaminants on site to minimise the risk of spill; and
  - a program for reviewing and updating the numerical groundwater model as more data and information become available; this program will include reporting requirements.
- As part of the WMP, the existing environmental monitoring network will be reviewed and adjusted to ensure adequate spatial coverage and collection of data to validate and update groundwater modelling predictions.

Monitoring

- The following surface water monitoring program will be commenced during construction:
  - a comprehensive surface water monitoring project across the area to collect data from all identified spring locations;
  - additional baseline surveys on landholder properties downstream of the mine project area, along the Belubula River, including collecting information regarding springs and existing bores;
  - follow-up surveys at the previously surveyed sites to confirm the results of the subterranean fauna surveys;
  - install surface water flow monitoring locations in the mine development area;
  - installation of additional groundwater monitoring bores in the TSF area (for monitoring until project infrastructure removes the bores), south, west and east of the TSF (for monitoring prior to, during and post-mining); and
  - installation of additional groundwater monitoring bores in the vicinity of the waste rock emplacement area and water management facilities (for monitoring prior to and during operations).

- The following monitoring will be conducted during operations:
  - routine monitoring of all three proposed streamflow monitoring stations, including continuous water quality monitoring sensors for pH, EC, temperature and turbidity;
  - annual monitoring via established photo and assessment points on the Belubula River downstream of the proposed TSF (to be established immediately prior to construction) at approximately 50 m intervals;
  - routine monitoring of water quality for all site water storages;

Table 38.1 Summary of commitments - mine development

- – routine health monitoring of PCT 951 vegetation;
- – routine inspections of sediment control structures as well as inspections following rainfall events of 20 mm or more in a 24-hour period;
- – monitoring of the stored water volume in each storage on-site, including the open cut; and
- – monitoring of volumes of water pumped between selected storages in the water management system.
- – All water quality monitoring will be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (2004).

Noise, vibration and blasting

- Noise and vibration will be managed during construction and operation in accordance with the relevant measures detailed in the CEMP and OEMP respectively.

Construction

- During the first six months of construction, works will be undertaken during standard construction hours, as per the ICNG. Outside of these hours, some works may be carried out as required (such as limited construction activities, environmental management such as dust control, delivery of oversized equipment, and servicing of equipment). In these circumstances, works will be undertaken in accordance with the noise criteria for outside of recommended standard hours in the ICNG.

The following general management and mitigation measures will be implemented during the construction phase of the project:

- ensure construction activities meet NMLs for standard construction hours and out of hours periods provided in Table 10.5 of this EIS as far as practicable;
- where feasible, construction activities will be avoided adjacent to residential receivers between 6 pm to 7 am;
- for residential receivers that are predicted to experience exceeded NMLs (R17), reasonable and feasible noise controls will be implemented to minimise noise emissions;
- alternative measures to minimise noise related impacts on the community will be adopted if noise control measures do not adequately address any exceedances;
- management and mitigation measures noted in AS2436-2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites* will be implemented if reasonable and feasible;
- construction noise levels will be monitored to validate the predicted construction noise levels. Predicted levels will be subsequently re-evaluated at assessment locations if required; and
- affected landholders will be consulted before and during construction where exceedance of NMLs are predicted and will be notified of proposed mitigation measures that will be used to manage construction noise levels to below ICNG NMLs.

Operations

The following reasonable and feasible mitigation measures will be applied:

- application of noise suppression to key mobile equipment (trucks, excavators and drills) so that the noise envelope remains consistent with that presented in the NVIA (in Appendix L);
- enclosure of the primary crusher in the ROM pad;
- construction of two noise barriers – the 'pit amenity bund' and the 'southern amenity bund' of the waste rock emplacement – as quickly as possible to serve as noise and visual barriers between mining operations and receivers in Kings Plains;

Table 38.1 Summary of commitments - mine development

• reduced mining operations for the evening and night-time periods in adverse weather conditions during the construction of the 'pit amenity bund' and the 'southern amenity bund' as follows: – a reduced in-pit fleet (2 x excavators; 1 x drill; 1 x wheel dozer) until the pit reaches a depth of approximately 100 m (RL 850 m); – reduced haulage (approximately 60% reduction) from the pit to the ROM and the pit to the waste rock emplacement until the completion of the amenity bunds; and – tracked dozers only to operate during the daytime period, with wheeled dozers to be used during the evening and night-time periods. • mine scheduling will create protected dump locations for night-time dump locations in the daytime to minimise noise emissions during the more sensitive night-time period. • A noise management plan will be developed as part of the OEMP, which will: – identify noise-affected properties consistent with the noise and vibration assessment and any subsequent assessments; – outline mitigation measures to achieve the noise limits established; – specify measures to quantify, document and ameliorate impacts that are greater than predicted, if they occur; – specify protocols for routine, regular attended and unattended noise monitoring of the project; – outline the procedure to notify property owners and occupiers that could be unduly affected by noise from the mine; and – establish a protocol to handle noise complaints that includes recording, reporting and acting on complaints. • a real-time noise monitoring system will be installed to measure and report live operational noise levels.
Blasting
• The MIC for blasts at the mine development will be limited to 300 kg, unless completion of test blasts to validate predicted blasting emissions provided in Table 10.21 of the EIS finds that a different MIC can be used to achieve compliance at the nearest sensitive receiver. Blasts will be limited to the hours of 8am to 4pm, Monday to Saturday, unless otherwise agreed to in consultation with the EPA and in favourable wind conditions, when it can be demonstrated that it is necessary to proactively manage safety and environmental issues.
Air Quality
• Air quality will be managed during construction and operation in accordance with the relevant measures documented in the CEMP and OEMP respectively.
Particulate emissions
• chemical dust suppressants will be applied to high traffic routes exiting the pit to the ROM pad and to the waste rock emplacement. All other unpaved transport routes (eg pit, ramps, topsoil haulage) will be controlled through water suppression; • a road speed limit of 60 km/hr will be posted to all internal roads; • the design of crushers, screens and associated transfer points at the processing circuit will include dust control, dust extraction and / or filter systems; • all exposed conveyors at the processing circuit will be covered; • water sprays will be utilised at the ROM pad hopper / primary crusher dump pocket;

Table 38.1 Summary of commitments - mine development

- ROM pad operations will be controlled through the use of water carts and / or water sprays;
- the fine ore stockpile will be covered;
- in pit drill rigs will be fitted with dry filter capture devices;
- wet suppression via water carts will be applied to dozer activity areas for waste rock emplacement and topsoil operations; and
- topsoil stockpiles, waste rock emplacement and TSF walls will be progressively rehabilitated through hydro mulching, hydro seeding, or something similar.

Diesel emissions

- where feasible, equipment compliant with a more recent emission standard than USEPA Tier 2 will be sourced;
- the use of electric powered mining equipment will be considered during detailed design;
- open cut pit haulage ramps will be designed to reduce the gradient of travel as much as feasible;
- haul roads will be routinely maintained to reduce truck tyre rolling resistance;
- the distance of material haulage to ROM pad and waste rock emplacement will be optimised to reduce haulage distances wherever feasible;
- all equipment will be routinely serviced to maintain manufacturers' emission specifications;
- idling of diesel equipment will be minimised wherever feasible; and
- low sulphur diesel fuels and lubricants will be used where feasible.

Greenhouse Gas

The following measures will minimise the GHG emissions from the mine development:

- adoption of energy efficient lighting technologies and hot water and air conditioning systems wherever practical;
- use of alternative energy sources where feasible, such as solar power;
- undertaking periodic audits and reviews on the amounts of materials used, amount of mine waste and non-mine waste generated and disposed; and
- sourcing of materials locally where feasible to minimise emissions generated from upstream activities.

Biodiversity

Terrestrial biodiversity

- the limit of approved disturbance areas will be identified on the ground via survey to ensure that all ground disturbing activities are only undertaken within approved areas;
- retained areas of the EPBC Act listed community comprising PCT 1330 White Box-Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland in the mine project area will be designated as no-go zones (with the exception of entry for environmental management);
- pre-clearing inspections will be undertaken to identify and, where practicable remove, nesting or roosting fauna;
- specific procedures will be developed and implemented for Koala pre-clearing inspections and safe relocation outside the clearing area;
- revegetation will be undertaken to increase the connectivity of fragmented patches of Koala habitat within the project area throughout the mine life;
- staged clearing of native vegetation and fauna habitat will be undertaken to minimise impacts to native fauna

Table 38.1 Summary of commitments - mine development

species;
- cleared vegetation will be stockpiled onsite for use during rehabilitation operations, where practicable. Larger vegetation may be retained whole for use in rehabilitation operations on site;
- a weed and pathogen monitoring program will be implemented to monitor impacts to retained vegetation outside the disturbance footprint, but within the project area;
- weed management and pest control programs will be undertaken in consultation with surrounding landholders, based on the results of the weed and pathogen monitoring program;
- progressive rehabilitation will be undertaken where practical throughout the mine life; and
- a biodiversity offset strategy will be developed, in consultation with OEH, to meet the project's offset obligations.

The above measures will be documented in a biodiversity management plan.

Aquatic ecology

- ongoing monitoring and assessment of mine development impacts on aquatic and riparian ecology will be undertaken, as detailed in the biodiversity management plan;
- appropriate aquatic rehabilitation programs will be implemented outside the mine disturbance footprint along waterway banks and within the riparian zone, as documented in the biodiversity management plan;
- where possible, existing dams, weirs or other in-stream structures not critical to mine development function will be removed to increase the potential for movement of aquatic fauna;
- engagement with stakeholders will be undertaken to promote catchment improvement programs for the Belubula River above Carcoar Dam; and
- an aquatic ecology offset strategy will be prepared and implemented in consultation with DPI Fisheries and in accordance with the *Biodiversity Offsets Policy for Major Projects Fact Sheet: Aquatic Biodiversity* (DPI 2014).

Aboriginal heritage

- an Aboriginal cultural heritage management plan (CHMP) will be prepared in consultation with the RAPs and OEH, which will detail management of Aboriginal heritage items during construction and operation of the mine development generally in accordance with the measures outlined in Table 15.4 in Chapter 15 and Appendix P of the EIS. The CHMP will also outline the protocol for unanticipated finds such as artefacts and skeletal remains.
- invitation for the continued participation of RAPs; in particular for the recording, collection, curation, storage and replacement of artefacts;
- cultural awareness training will be provided for site personnel through the site induction process; and
- Regis will consult with the Orange Local Aboriginal Land Council regarding the commission of a social and cultural mapping study with relevant traditional owners for the project area.

Historical heritage

- a historic heritage management plan will be prepared in consultation with DPIE and the Department of Premier and Cabinet - Heritage, Community Engagement. The plan will describe the measures to manage and mitigate historic heritage impacts during construction and operation of the project, generally in accordance with the management measures documented in Table 16.5 in Chapter 16 and Appendix P. The management plan will also outline the protocol for unanticipated finds such as artefacts and skeletal remains;
- cultural awareness training will be provided for site personnel; and
- a built heritage specialist and a historic heritage archaeologist will be engaged to carry out further assessment of the Hallwood farm complex (MGP-23) to confirm the aesthetic, technical and archaeological significance

Table 38.1 Summary of commitments - mine development

values of the site.

- Regis will carry out archival recording of Hallwood in accordance with the methodology documented in the CHMP.

Traffic

- a traffic management plan will be developed to manage development-related traffic within the mine project area and surrounding road network during the construction and operation phases. The plan will include a driver code of conduct and strategies to manage and monitor driver fatigue, road hazards and driver behaviour;
- to reduce the impact of project-related traffic on Vittoria Road and Guyong Road, workers travelling to the mine project area from within the Orange and Cabonne LGAs will be encouraged to use an alternative route via Millthorpe Road to Blayney, then along the Mid-Western Hwy to the new access intersection.
- workers that do not live adjacent to Vittoria Road and Guyong Road or where an alternative route to the project area would take significantly longer, will be required to use an alternate route to the mine project area;
- all contractors and subcontractors based in Orange and Cabonne will also be contractually required to use the alternate route to the mine project area. Buses used to transport workers will also use this route;
- truck washing bays with tyre washing stations will be constructed near the mine access/egress area to eliminate mud tracking onto the Mid Western Highway until such times as the internal roads are sealed;
- a new intersection will be constructed off the Mid Western Highway to provide access to the mine project area, approximately 190 m west of the Walkom Road (east) intersection and will consist of an auxiliary left turn lane and a channelised right turn lane;
- once constructed, all vehicles will access the mine site via the new access road off the Mid Western Highway;
- truck advanced warning signage will be installed 300 m in advance of the intersection in both directions along the Mid Western Highway;
- the permitted routes and time restrictions for oversize vehicles, which may include either night-time or daytime deliveries, will be determined in consultation with RMS and documented in the CEMP and OEMP before construction commences. RMS will decide on the oversize vehicle routes and travel times for the project on a case by case basis in accordance with its policy for oversize vehicle movements within key transport routes; and
- fog-activated warning signs will be installed on the Mid Western Highway in advance of the new access intersection, in consultation with and the approval of Roads and Maritime Services.

Visual amenity

- The following project design measures will be adopted:
  - the pit and southern amenity bunds will be developed as a priority to screen development of the open cut, infrastructure and haul roads in the early stages of mine development;
  - the waste rock emplacement staging will be refined to create progressive minor screening bunds; and
  - micro-topographic design will be incorporated into the final landform.
- Onsite visual mitigation measures will include:
  - open cut mine pit:
    - continue seed collection from native vegetation that is proposed to be cleared prior to commencement of clearing for use in replanting and landscape rehabilitation programmes;
    - implementing machinery and vehicle exclusion zones to protect remaining vegetation;
    - utilise barriers, such as shipping containers, which are consistent in colour to the surrounding vegetation and strategically positioned where required to provide screening for residential receivers

Table 38.1 Summary of commitments - mine development

from the open cut mine pit; and - plan vehicle routes on the open cut mine pit to minimise direct light to residential receivers located south of the project area where practical. - waste rock emplacement area: - complete rehabilitation of the southern and western faces of the waste rock emplacement area as soon as possible; - a planting strategy with be designed with the community using a combination of grasslands, woodlands and cultural planting patterns that emulate existing patterns in the landscape; and - new plantings will be maintained and where necessary replacement landscape works will be undertaken to ensure planned patterns are achieved and viable. - ROM pad: - the ROM pad and retention batters will be rehabilitated early in the mine life with vegetation consistent with the existing vegetation pattern and type of the surrounding landscape; - remaining and planted vegetation will be maintained and any areas with unsatisfactory levels of regrowth will be reseeded; and - barriers, such as shipping containers, which are consistent in colour to the surrounding vegetation will be strategically positioned to provide screening for residential receivers from the ROM pad. • Off-site mitigation will be carried out in consultation with land holders that will experience moderate to high visual impacts.
Lighting
• Lighting during construction and operation will comply with AS/NZS: 4282:2019 Control of the Obtrusive Effects of Outdoor Lighting. Additional measures to lessen the impact of direct and diffuse lighting will include: – appropriate positioning and aiming of lights; – use of shielded fittings where appropriate: – restriction of night lighting to minimum timeframes required; – use of energy efficient lighting where appropriate; – use of asymmetric beamed flood lights where appropriate; and – use of warm coloured fixed lights where possible.
Hazards and Risks
Bushfire
• vehicle refuelling will be confined to designated refuelling bays (where practicable); • fire extinguishers will be provided in buildings, vehicles and refuelling areas; • spill response kits will be available; • firefighting water reticulation with diesel pump backup will be provided to surface infrastructure facilities; • the Emergency Response Plan (ERP) will be reviewed after incidents of bushfire or other fires as well as annually at the end of each bushfire season (approximately April-August) and amended, if required; and • A bushfire management plan will be prepared and implemented for construction, operation and decommissioning, which will govern the implementation of the above listed management measures.
Hazardous materials

Table 38.1 Summary of commitments - mine development

- explosives will be stored in a magazine facility designed to meet the separation and design requirements in *AS2187.2 2006 Explosives – Storage, Transport and Use*. Sodium cyanide will be stored in accordance with the International Cyanide Code; and
- a hazardous materials management plan will be developed, which will describe the measures that will be implemented to ensure the safe handling, storage and transportation of hazardous materials used onsite.

Social

- To address existing fears and perceived uncertainty in relation to the health impacts of dust emission, Regis has commissioned a health impact assessment, to be completed in parallel with the project approvals process.
- Prior to commencement of construction Regis will develop a Construction Workforce Accommodation and Management Strategy (CWAS) to address the predicted impacts of the construction phase workforce on housing and short-term accommodation supply in the Blayney LGA. The strategy will be prepared in consultation with BSC, Orange360 and key accommodation providers.
- In addition to the CWAS, Regis will:
  - focus on securing local contractors during the construction phase, to reduce the size of the NLH workforce;
  - monitor local and regional housing market activity in the period prior to construction to inform the CWAS, and make changes to the workforce accommodation strategy as necessary to manage potential impacts;
  - engage further with Orange360 and accommodation providers in Bathurst and Orange LGAs to confirm occupancy rates and availability in short-term accommodation options in these locations;
  - reduce workforce demands during periods of high regional accommodation demand e.g. Bathurst 1000, to free up short-term accommodation for the tourism industry sector;
  - following commencement of operations, provide Orange360 with the long-term maintenance shutdown schedule for the mine, and where necessary ensure alignment of shutdown periods outside of periods of high accommodation demand eg Bathurst 1000;
  - communicate with larger operating companies such as Purina, CVO and SeaLink to understand any expansion/reduction in services that may impact short-term accommodation availability in Blayney during the construction phase and take necessary action through the CWAS and in coordination with these companies to minimise any adverse impacts;
  - undertake further engagement with Housing Plus and other relevant housing support services to identify suitable actions to offset potential short-term impacts on low to medium income households in the Blayney LGA; and
  - establish joint meetings with representatives of other major projects or existing significant operations, such as CVO, in relation to any expansion work regarding management and monitoring cumulative impacts to the Blayney housing market.
- A Social Impact Management Plan will be developed, which will include the following:
  - Stakeholder Engagement Plan;
  - Corporate Volunteer Strategy;
  - Local Content Plan;
  - Indigenous Participation Plan; and
  - Recruitment and Training Strategy.

Rehabilitation and Closure

Rehabilitation

Table 38.1 Summary of commitments - mine development

• The overarching rehabilitation objective of the mine development is to restore the land as much as possible to its pre-mining land use, ultimately, an agricultural land use comprising of grazing on improved pasture, combined with some woodland areas. • Within five years prior to mine closure, Regis will prepare a detailed mine closure plan with the aim of creating a land use capability compatible with the pre-mining agricultural land use (unless other beneficial uses are pre-determined and agreed).

38.4 Summary of commitments – pipeline development

A summary of the key commitments associated with the construction and operation of the pipeline development is presented in Table 38.2.

Table 38.2 Summary of Commitments: Pipeline development

Soils
• Soil erosion and sediment management will be implemented during construction activities generally in accordance with the Blue Book. • Soil testing for the following will be undertaken during the detailed design stage: – Salinity, particularly in the identified high hazard areas referenced in section 23.2.4 of the EIS; – acid sulfate soils, particularly in the areas identified as having a probability of occurrence (albeit low) and in the areas which have been submerged such as around the Macquarie River, Saltwater Creek, Evans Plains Creek and Queen Charlottes Creek; and – naturally occurring asbestos in the area identified in the Vittoria State Forest. – a risk assessment will be carried out in relation to potential asbestos containing sites to identify the risk of airborne asbestos released into the air. • An unexpected finds protocol in relation to contamination will be developed. Any excess soil emanating from Centennial's Angus Place, SCSO or EA's MPPS to be disposed of off-site will be characterised and disposed of in accordance with the waste classification guidelines (DECC 2014). • Any naturally occurring asbestos identified in the pipeline corridor will be managed and remediated in accordance with Regis' naturally occurring asbestos procedure.
Biodiversity
• where possible, the pipeline will be trenched into existing roads and tracks, minimising impacts to native vegetation and threatened species habitat; • impacts to biodiversity will be managed through the implementation of measures as documented in the CEMP for the pipeline development, such as: – the limit of approved disturbance areas will be identified on the ground via survey to ensure that all ground disturbing activities are only undertaken within approved areas; – pre-clearing inspections will be undertaken to identify and, where practicable remove, nesting or roosting fauna.
Water Resources
Construction

Table 38.2 Summary of Commitments: Pipeline development

• refuelling of plant and equipment will be constrained to designated/bunded areas or will be off site; • chemicals and construction materials will be stored appropriately in designated/bunded areas; • waste management plans will be developed and implemented for the control and storage of waste at work sites; • operations at work sites will be reviewed and audited to ensure management measures are being implemented accordingly; • laydown areas and equipment compounds will be located away from flood prone area; and • when flood risk is notified, active work sites will be secured and personnel moved off site.
Operation
• during pipeline maintenance, process water removed from the pipeline via valves will not be discharged to rivers or creeks. It is anticipated that process water held in the pipeline sections that require maintenance will be removed via tanker trucks and taken either to the mine project area, an appropriately licensed wastewater treatment facility, or pumped to the nearest pumping station or the next appropriate pipeline section. Monitoring of pipeline flows and operation of isolation valves will reduce the magnitude of water released to the environment in the event of a pipeline leak.
Noise and vibration
• construction activities will meet construction noise management levels within the allowable hours of operation as far as practicable, as outlined in Chapter 25 of the EIS; • where feasible, construction activities will be avoided adjacent to residential receivers between 6pm to 7am (especially vegetation clearing and rock breaking); • where noise levels are above relevant noise management levels, reasonable and feasible best practice noise controls will be implemented to minimise noise emissions and/or exposure duration at affected receivers; and • where the use of best practice noise controls does not adequately address exceedance of noise management levels, alternative measures will be adopted to minimise impacts on the community.
Air quality
• prior to commencement of construction activities, appropriate communications will be undertaken to notify the potentially impacted residences of the project (duration, types of works, etc) and provide relevant contact details for environmental complaints reporting; • a dust complaints log book will be maintained throughout the construction phase, which identifies the cause(s) and appropriate measures taken to reduce emissions; • exceptional incidents that cause dust and/or air emissions will be recorded, and the action taken to resolve the situation in the log book; • regular site inspections will be conducted, with inspection results recorded; • site fencing and barriers will be kept reasonably clean using wet methods; • a maximum-speed-limit of 20 km/h will be imposed in the vicinity of work areas; • vehicles entering and leaving sites will be covered to prevent escape of materials during transport; • plant and equipment engines will be maintained; • an adequate water supply on the construction site will be maintained for effective dust/particulate matter suppression/mitigation; • drop heights from loading or handling equipment will be minimised as much as practicable; and

Table 38.2 Summary of Commitments: Pipeline development

• vegetation/ground cover will only be removed in small areas during work, as practicable.
GHG
The following measures will minimise the GHG emissions from the pipeline development: • routine maintenance of equipment fleet to ensure optimal engine operation; • minimise engine idling wherever practical; and • use of alternative energy sources where feasible, such as onsite solar power.
Aboriginal Heritage
• the seven sites (AHIMS #44-3-0222, #44-3-0223, #44-3-0224, #44-3-0225, #44-3-0228, #44-3-0229 and #45-1-2548) which will be directly impacted in the pipeline corridor will be salvaged through the recording and collection of surface artefacts. Artefacts will be stored in accordance with the procedures outlined in the Aboriginal cultural heritage management plan; • salvaging, including the recording and collection of the surface artefacts, will be done in consultation with the RAPs; • due to the proximity to the pipeline corridor, temporary buffers will be erected using high visibility ground markers, around the three sites outside of the corridor prior to and during construction works to prevent inadvertent disturbance, except for CS SU4-A2 as the site is already permanently fenced; and • an unanticipated discovery protocol for any previously unidentified items/areas of potential Aboriginal archaeological significance, including skeletal remains, will be prepared.
Historical heritage
• the Leeholme Homestead and outbuildings and the Portland General Cemetery will be indicated as 'no-go zones' on the construction management plans and all contractors made aware of the two locations in *McPhillamys ACHAR* (see Figure 13 1 and Figure 13 2 in Appendix Z); and • an unanticipated finds protocol will be developed to manage potential unanticipated historic heritage finds during construction works.
Traffic
• A construction traffic management plan will be prepared which will include: – proposed work hours – including work hours that minimise disruption to road network; – construction vehicle access route – establishing routes to the construction sites and any deficiencies that will impact the road network; – vehicle diversion routes – detour routes implemented to maintain traffic flow in the unlikely event public roads will require temporary closure; – traffic control for partial road closures – maximise safety by ensuring traffic control complies with best practice with vehicle movement, signage and warnings signs assessed; – route maintenance – road network will be maintained to its pre-construction condition, and in accordance with the inventory to be documented with relevant agencies; – construction staff parking – parking to be provided on-site and staff transported by group transport where possible; – driver code of conduct and inductions – all drivers to adhere to the driver code of conduct and subcontractors are to be inducted with procedures for vehicles entering the construction areas; – development of monitoring program – project manager on site to monitor and document the effectiveness

Table 38.2 Summary of Commitments: Pipeline development

of the CTMP; and – communications strategy – notify and engage all stakeholders and landowners of traffic changes anticipated prior to works commencing.
Social
• a Landholder Communication Plan will be developed as part of the property management plan for each property directly impacted by the pipeline development to ensure adequate notification of the construction phase is provided to all directly affected landowners; • letterbox drops will be carried out prior to the start of noisy construction works as required; • a formal complaints procedure will be included in the CEMP for the pipeline development and the OEMP for the overall project; • a Construction Workforce Accommodation Strategy will be prepared in consultation with key stakeholders. The strategy will: – demonstrate how the construction phase workforce will be accommodated across the local area; – demonstrate how workforce accommodation requirements will be managed during periods of high demand, such as during key regional events including Bathurst 1000; – document the approach to informing accommodation providers of predicted pipeline development workforce accommodation demands including anticipated timing; and – enable the coordinated placement of the workforce in tourism accommodation throughout the local area. • Regis will undertake a Local Content Plan to provide a detailed analysis of identified existing local enterprise and the skills / education base of local residents. Wherever possible, the pipeline development supply and workforce requirements will then be 'matched' with existing capabilities in the local community.

Part G

Justification and conclusion

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Chapter 39

Project justification



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39 Project justification

39.1 Introduction

This chapter addresses the environmental assessment requirements relating to the reasons why the McPhillamys Gold Project should be approved, having regard to:

- relevant matters for consideration under the EP&A Act, including how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the project;
- the biophysical, economic and social costs and benefits of the project; and
- the suitability of the site.

It is noted that a discussion on how the project accords with the objects of the EP&A Act is provided in Chapter 3 (refer to Section 3.2.4). The alternatives considered for the project are also discussed in Chapter 6, outlining why the project design for which approval is sought is the most appropriate and feasible option for the development.

39.2 Significance of resource

39.2.1 Demand for gold

The product of the mine will be gold ore, in the form of unrefined gold bars. As described in Section 1.6, gold is used in a variety of applications such as in jewellery, as an investment instrument for governments, central banks and private investments, in the electronics industry, in medical and dentistry applications, and as global backed exchange traded funds.

Australia is the second largest producer of gold in the world, and therefore plays an essential part in meeting the global demand for gold.

Gold prices are projected to rise gradually over the next five years to an average US$1,428 an ounce (2019 dollars) in 2024, as gold's status as a safe haven asset boosts investor demand over the short term and at the same time world mine supply declines from 2020. World gold consumption increased by 4.5% in 2018, to 4,345 tonnes, led by central bank buying (up 74%), which was the highest level of purchases in 50 years, and retail investment (up 4.3%). Some countries increased their gold purchases in order to diversify away from the US dollar.

This increase in gold consumption is predicted to continue in the short term, with consumption forecast to rise by 6.6% and 2.1% in 2019 and 2020, to 4,630 and 4,728 tonnes, respectively. The March 2019 *Resources and Energy Quarterly Report* from the Australian Government's Office of the Chief Economist observes that ongoing trade tensions between the US and its trading partners, a global economic slowdown, steady US Treasury bond yields, a lower US dollar, and Brexit uncertainty are all expected to dampen consumer and business confidence, and boost safe haven demand for gold.

After 2020, a decrease in central bank purchases and industrial demand for gold is predicted. However, this fall in demand is expected to be offset by a rise in global jewellery consumption in China and India, which are the world's two largest jewellery markets.

39.2.2 Gold production

World gold production is projected to fall after 2020, as some long and large established mine projects in Australia and other major gold producing countries reach the end of their mine life. World mine production grew marginally in 2018, rising just 0.8% to 3,347 tonnes; however, world gold production is projected to decline after this peak as long established mine come to an end and few new projects and expansions take their place. World mine production is projected to fall from 3,347 tonnes in 2018 to 3,001 tonnes in 2024. Declining world mine production is expected across most major gold producing countries and will be particularly evident in Australia, which is expected to account for over 153 tonnes of closing mine capacity between 2019 and 2024.

After reaching a peak in 2019–20, Australian mine production is projected to decline by 7.3 per cent annually to 255 tonnes in 2023–24. The March 2019 *Resources and Energy Quarterly Report* predicts that production will be weighed down by several mine closures, as mature assets approach their end of life. For example, Gold Fields' 7.5 tpa Agnew operations in Western Australia (WA) is expected to close in 2021. Northern Star's 9.4 tpa Jundee gold operation in WA is also expected to cease production in 2023. Newcrest's 13 tonnes per year Telfer gold operation in WA is expected to close in 2024.

To offset this decline in production, new mines will need to come online. The Office of the Chief Economist identifies the McPhillamys Gold Project as one of these potential operations.

39.2.3 Significance at a local level

At a local level, the *Central West and Orana Regional Plan 2036* (DPE 2017a) (the Regional Plan) highlights the important role the mineral resources sector plays in underpinning many local economies in the region, noting that mining represented the largest contributor to gross regional product at $2,508 million in 2011. Priorities of the regional plan include continuing to grow and support the mining sector in the Blayney and Cabonne local government areas.

As described in Section 3.6.1, the Regional Plan was released by the DPE in 2017 to guide land use planning priorities and decision making in the Central West and Orana Region for the next two decades. The region covered by the plan comprises the Cabonne, Orange, Blayney, Bathurst Regional, Lithgow, Oberon, Lachlan, Parkes, Forbes, Weddin and Cowra LGAs (Central West), and the Bogan, Warren, Coonamble, Gilgandra, Narromine, Warrumbungle and Dubbo Regional Mid-Western Regional LGA's (Orana). The Regional Plan provides an overarching framework to guide local land use plans, development proposals and infrastructure funding decisions. The implementation component of the Regional Plan includes priority actions and medium-long term actions.

The Regional Plan identifies the mining sector as the largest contributor to the regional economy, comprising $2.5 billion (16.2%) of gross regional product in 2011 and employing 5% of the regional workforce. The vision for the Central West and Orana region is for mining to continue to provide local job opportunities and make a significant regional economic contribution. Specifically, and of relevance to the project, is that mining is identified as one of the top three economic opportunities for the Blayney and Cabonne LGAs.

The Regional Plan sets four broad goals for the region; the number one goal being that the regional economy becomes the most diverse regional economy in NSW. The project is consistent with this goal, as it will contribute significantly to the diversity of economic development and employment in the region and will enable the realisation of the economic opportunity that mining presents, as identified in the plan.

The Regional Plan also sets a number of 'directions' for each goal. The project is consistent with the sustainable management of mineral resources actions identified in Direction 8 for Goal 1, which states that the sustainable management of mineral resources must consider and balance varying impacts to produce long-term economic, social and environmental outcomes. The project will deliver significant economic benefits to the region, as discussed below in Section 38.3.

Regis is committed to the employment of a majority local workforce, and through the implementation of training and apprenticeship programs will deliver long-term social benefits to the region. Implementation of the rehabilitation and closure strategy (refer to Chapter 22) will also ensure that the project leaves a stable and sustainable post-mining landform.

39.3 Economic justification

The project is justified economically due to the net economic benefits and the economic stimulus it will provide locally and to NSW, as discussed below. Importantly, the project involves a mining operation that will, consistent with the objects of the Mining Act, extract a State-owned resource for the benefit of the State of NSW.

A project is economically beneficial if its benefits exceed its costs measured in today's values (known as net present value or NPV). The direct net benefit of the project for NSW is estimated at $235 million in NPV terms (present values at 7% discount rate), comprised of the following:

- royalties of $47 million;
- company tax payments of $31 million;
- net producer surplus of $65 million;
- employment wage benefits of $32 million; and
- non-market benefits of employment of $60 million.

To determine the net direct economic benefit, costs associated with GHG emissions and impacts to heritage, collectively estimated at just over $2 million, were deducted. This generates a net direct benefit to NSW of $232 million (present values at 7% discount rate).

A number of flow-on effects will occur as a result of the project's capital and operating expenditure, and job creation, which will benefit the regional economy. As described in Chapter 36, the total annual impact of the project on the regional economy is estimated to be up to:

- $531 million in annual direct and indirect regional output or business turnover;
- $218 million in annual direct and indirect regional value added;
- $114 million in annual direct and indirect household income; and
- 1,289 direct and indirect jobs.

The project operation is estimated to make up to the following contribution to the regional economy:

- $492 million in annual direct and indirect regional output or business turnover;
- $272 million in annual direct and indirect regional value-added;

- $67 million in annual direct and indirect household income; and
- 788 direct and indirect jobs.

Further, and as discussed in Chapter 3.2.4, the change in land use from agriculture to mining area and the corresponding reduction in agricultural carrying capacity of the project area will result in a decline in the net value of agricultural production by $406 193/yr during the life of the mine. This equates to just under 1% of the $42.7 million of gross value of agriculture production in Blayney LGA in 2015/16 (ABS 2018). With a net benefit to NSW of between $141 million to $232 million, the project therefore represents the highest value land use compared to the existing agricultural use. Wages for labour will contribute to the regional economy, as well as regional spending for production related inputs.

From an economic perspective, the project is therefore clearly justified on economic grounds.

39.4 Social justification

The project will directly benefit the Blayney LGA, as outlined in the Social Impact Assessment (Hansen Bailey 2019), through the following;

- direct and indirect employment generation;
- investment in community infrastructure and services, made possible through a VPA, or similar mechanism, to be negotiated with Blayney Shire Council;
- investment in education and training as Regis seeks to build a local skill base to support labour supply for the project;
- project procurement spend, as Regis is committed to supporting local businesses to participate in the project procurement process; and
- direct and indirect population growth. The project will attract new residents to the Blayney LGA, of which the majority are anticipated to reside in Blayney.

The economic assessment modelled the direct and indirect jobs (ie from flow-on effects) that the project will provide, which are significant and are as follows:

- 1,289 direct and indirect jobs during construction; and
- 788 direct and indirect jobs during operations.

Regis is committed to the employment of a majority local workforce.

Whilst the net social benefits will be significant, it is acknowledged that adjoining landholders will primarily bear any residual environmental impacts, particularly associated with noise and visual amenity. As described in Chapter 6, extensive investigations were carried out in the project planning phase to explore all reasonable and feasible noise and visual mitigation measures, which have been incorporated into the project design. This has resulted in minimising the number of adjacent landholders that will experience exceedances of relevant noise criteria early in the project life, and Regis has commenced negotiations with these landholders regarding further appropriate mitigation measures to be implemented.

Based on the above, the project has social merit. There will be significant net positive social outcomes largely due to local procurement and workforce recruitment; a social management plan to ensure effective implementation; and a VPA or similar mechanism which can be used by council for the benefit of the local community.

39.5 Environmental justification

A summary of the key findings of the environmental assessment and the mitigation and management measures committed to is provided in Chapter 37 and Chapter 38, respectively. As shown, the project has been designed such that impacts are either avoided, or appropriate mitigation measures identified so that the residual impacts of the project, on balance, will be acceptable.

39.6 Suitability of the site

The McPhillamys Gold Project is located in a region where mining is identified as one of the top three economic opportunities (DPE 2017a). Mining has a long history in the Blayney LGA, and many of the towns in the LGA owe their existence and growth to the early gold mining industry. The mine project area also shares this mining history, where historical gold mining activity occurred for many years. Mining was recorded within the alluvial deposits of the Belubula River and hard rock mining at several locations including the historical McPhillamys Mine on the "Ingledoon" property, between 1884 and 1967. These historical miners were targeting what is now understood to be a valuable gold mineralisation within the mine project area, approximately 200 m in diameter beginning near the surface and extending near vertically to depth.

The project area currently comprises mostly cleared open paddocks utilised for cattle grazing and some limited cropping, consistent with the dominant agricultural land use in the surrounding area. This is also consistent with the land use zoning of the locality. As described above in Chapter 3, the land in and surrounding the mine project area is zoned RU1 Primary Production (a zone where mining is permissible), with the exception of the Vittoria State Forest adjacent to the north-east boundary (zoned RU3 Forestry) and the Mid Western Highway (zoned SP2 Infrastructure) running along the southern boundary of the mine project area. Land zoned RU2 Rural Landscape lies further to the south-west, approximately 1-2 km from the southern boundary of the mine project area.

The area within the disturbance footprint of the mine development has been verified as not being Biophysical Strategic Agricultural Land (BSAL). A small portion of BSAL is within the south-west corner of the project area and, once identified, this area of land was excised from the mine development footprint and the mining lease application area. The mining land use proposed for the site will therefore not remove any BSAL. In addition, as described in Section 3.2.4, the proposed land use of mining represents a significantly higher value land use for the site compared with the existing agricultural land use.

A key component of the mine development is the TSF. A detailed assessment of location options for this facility was undertaken, both within and outside of the project area, to find the most suitable site. As described in Chapter 6, the outcomes of the assessment determined the proposed location within the Belubula River valley as the preferred option due primarily to optimal geology with respect to groundwater permeability to protect the downstream Belubula catchment. This location was also considered the preferred location from a visual amenity perspective as the prevailing topography will shield views of the TSF from most offsite locations. In addition, the location accommodates an efficient TSF in terms of engineering design, in particular, embankment construction and tailings rate of rise. The assessment therefore concluded that the site is particularly suited to a safe and efficient tailings storage facility.

In relation to surrounding land uses, a number of scattered rural residences occur to the north, south-east and west of the project area boundary. Due to a combination of factors including topography, project design including the siting of infrastructure, distance and weather conditions, significant impacts on these residences are not predicted to occur.

The settlement of Kings Plains is to the south of the project area, on the southern side of the Mid Western Highway. Impacts on these residences relating to noise, particularly in the first couple of years of the project, and changes to the visual amenity of the locality as a result of the project have been identified. Regis has accordingly committed to mitigation and management measures to address these residual impacts.

The site is suitable for the proposed mine for a number of other reasons. The project area is bounded to the south by the Mid Western Highway, which provides suitable access for both light and heavy vehicles to the site. The traffic assessment concluded that, considering the existing and projected traffic in the area, the roads in the vicinity have sufficient capacity to cater for the development.

The mine development will efficiently recover an economic gold resource from privately owned land where mining is permissible, and as such, in addition to factors discussed above, is considered a suitable site for the mine development. The fact there has been a granting of the right to explore with the intent to develop a mine in the area over a long period of time indicates the area is deemed suitable for mining activities, provided environmental impacts can be managed or mitigated. A range of commitments have been made by Regis to mitigate predicted residual impacts on surrounding land uses. When these commitments are applied, the project is unlikely to have significant land use impacts.

39.7 Ecologically sustainable development

The Commonwealth's *National Strategy for Ecologically Sustainable Development* defines ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'. The NSW EP&A Act adds to this by providing a set of ESD principles. The project's compatibility with each of the above principles is considered below.

39.7.1 The precautionary principle

The precautionary principle holds that where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent such damage.

The proposed mine plan and overall project design were progressively devised over several years and based on detailed investigations of geological, environmental, engineering and financial considerations. The baseline environmental investigations began in 2013 and have included groundwater, surface water, ecology, noise, soils, heritage, visual, social and economic conditions. All potential risks were identified and taken into account in the project design.

As explained in Chapter 6, project planning included multiple rounds of design, assessment and refinement to avoid impacts or, if unavoidable, minimise or offset them. Importantly, the principle of avoidance has been adopted wherever possible, particularly with respect to avoiding the identified critically endangered Box Gum Woodland in the project area by:

- reducing the footprint of the TSF through the addition of a northern embankment to avoid 5.1 ha of Box Gum Woodland; and
- positioning the secondary water management facility to avoid Box Gum Woodland in the project area.

The principle of avoidance was also adopted in designing the pipeline development, as follows:

- aligning the pipeline corridor so that it follows roads, tracks and open grazing land as much as possible;
- avoiding impacts to the native vegetation to the east of the MPPS pumping station facility No. 3 by underboring this part of the pipeline;
- aligned the corridor to avoid recorded populations of host plants (Bursaria spinosa) of the Purple Copper Butterfly. Impact to essential breeding habitat for the species has thus been avoided;

- refinement of the corridor to avoid mature, hollow-bearing trees and therefore impacts to hollow-nesting threatened species; and

- refinement of the pipeline development footprint to an approximate width of 6 m within areas of native vegetation to minimise vegetation clearing.

The result is that for all potential impacts no serious or irreversible harm will occur. Unavoidable impacts will meet applicable regulatory criteria, such as for air quality and water quality. Where some short-term impacts have been identified, such as for noise, mitigation measures will be implemented via negotiated agreements with affected landholders to address these impacts. A biodiversity offset strategy will be implemented such that a net positive biodiversity outcome is achieved.

Therefore, the project addresses the precautionary principle because there will be no serious or irreversible environmental damage.

Further, in relation to uncertainty, the technical assessments prepared in support of this EIS have been prepared by technical experts in each relevant field. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases of the project have been transparent. The contents of this EIS and accompanying appendices has enabled the potential implications of the project to be understood, and the management strategies, mitigation measures and monitoring activities required to ensure potential impacts are appropriately minimised, to be identified.

For environmental aspects where a potential high risk or particular community concern was identified in the early stage of project planning, further experts were engaged to peer review technical studies to ensure the robustness of the project design and the environmental assessment. This peer review process was undertaken in the areas of the TSF design, groundwater modelling, surface water management and the assessment of noise impacts.

39.7.2 Inter-generational equity

Inter-generational equity is the concept that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The only beneficial land use that could be affected by the project is agriculture. In this regard, the agricultural capability of the land to be disturbed will be progressively reinstated so that, with the exception of the final void, the project area can be used for agriculture at the end of the mine life. After production ceases, the pipeline development could remain in place and in doing so would remain a valuable infrastructure asset and enhance water security for future generations in the wider Central West region.

Some impacts on natural resources will occur, primarily through the removal of 132.36 ha of native vegetation; 44.22 ha of which is White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the BC Act and 18.5 ha is a CEEC listed under the EPBC Act. However, an offset strategy has been developed and, once implemented, will mean a net beneficial gain in biological resources.

A conservative water management system has been designed so that the mine will operate as a nil discharge site. There will be some effects on groundwater during and in the immediate years after mining due to water flowing into the open cut mine from the adjoining aquifer; however, no impacts greater than 2 m will occur at any privately-owned bore. Further, a robust TSF design has been developed so that during operation it can be effectively managed to ensure no significant onsite or offsite impacts to water resources occur, and so that a stable, non-polluting final landform is left at the end of decommissioning and rehabilitation of the mine.

A natural resource that will be lost is the in-situ gold. About 1.7 M ounces of gold will be removed over the life of the mine. Gold is a recyclable metal that can be reused for generations, meaning there will be no disadvantage to future generations from the loss of valuable materials. Further, the revenue generated by the project will be used to employ and up-skill the mine workforce and provide more community facilities and other social infrastructure, mainly through a VPA. This will allow natural capital (gold) to be transformed into economic capital (greater personal and public income), social capital (better public facilities) and human capital (a more skilled and wealthier workforce).

39.7.3 Conservation of biological diversity and maintenance of ecological integrity

This principle holds that the conservation of biological diversity and the maintenance of ecological integrity should be a fundamental consideration for development proposals. The potential impacts of the project have been described in this EIS, including the potential impact of the project on biodiversity, and identifies measures to address residual impacts.

The mine development is on land that has a long history of disturbance for agricultural use. Notwithstanding, areas of critically endangered Box Gum Woodland has been identified in the project area, as well as habitat for the listed species of koala and squirrel glider. Once these areas were identified, the mine layout was reviewed and amended to avoid as much of the Box Gum Woodland as possible, as explained above in Section 38.7.1. The pipeline corridor alignment has also been carefully aligned so that it follows already disturbed land such as road reserves and State forest land as much as possible.

For the areas of vegetation where clearing is required, offsets will be provided to compensate. Regis has purchased a property in the region for the purpose of establishing a biodiversity stewardship site. The overall outcome will be an increase in the area and quality of land conserved and enhanced for biodiversity protection, meaning the ecological integrity of the area will be strengthened.

39.7.4 Improved valuation and pricing of environmental resources

The principle of improved valuation and pricing of environmental resources is based on environmental factors being included in the valuation of assets and services. The cost associated with impacting upon the environment or an environmental resource is seen as a cost incurred to use that resource.

The EIS provides estimates of the monetary value of all material costs and benefits associated with the project. It includes estimates of the value of intangible (or non-traded) factors, such as noise and visual amenity impacts. The costs and benefits have been compared transparently to provide an estimate of the project’s net benefit. The result is a reliable estimate of the project’s economic value that provides useful guidance to decision-makers and other interested parties about the project’s overall merit.

Regis also acknowledges and accepts the financial costs associated with the measures required to avoid, minimise, mitigate and manage potential environmental and social impacts for the proposed development.

Chapter 40

Conclusion

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40 Conclusion

Regis is seeking development consent to construct and operate the McPhillamys Gold Project; a greenfield open cut gold mine and associated water supply pipeline, approximately 8 km from the township of Blayney in the Central West of NSW. The project comprises two key components:

- the mine site where the ore will be extracted and processed; and
- an associated water pipeline which will enable the beneficial re-use of water from near Lithgow to the mine site.

The project will provide a range of direct and indirect benefits to the local, regional and State economies over its 15 year life. The project is estimated to bring significant net social benefits to NSW of $232M (present value at 7% discount rate), and direct employment for an average of 260 people during operations. Including flow-on effects, the project operation will contribute up to 263 regional jobs and $18M in regional net income to residents.

Regis is an Australian listed gold miner with a proven record of developing gold mining operations and is one of the top five Australian gold companies by market capitalisation and production. Regis has established a local office in Blayney and is committed to making a positive contribution to the local community. The Blayney LGA in particular will benefit from the project as a result of investment in community infrastructure and services made possible through a VPA, investment in education and training as Regis seeks to build and augment a local skills base to support labour supply for the project, and project procurement spend as Regis is committed to supporting local businesses to participate in the project procurement process.

Many technical investigations have been carried out to support this EIS. These assessments identified residual impacts of the project and appropriate mitigation measures to address these impacts. The residual impacts of the project will mostly accrue to the residences closest to the mine project area, particularly in the settlement of Kings Plains. Mitigation measures for these impacts have been proposed particularly for noise, air and visual amenity, so that these residual impacts are reduced to an acceptable level.

The project will use excess water from mining and power generation operations in the Lithgow area as its primary raw water supply, enabling a beneficial re-use of otherwise excess water.

Numerous alternative designs have been evaluated for both the mine and pipeline developments, based on extensive geological, environmental, financial and other technical investigations that have been undertaken over a number of years. This process has facilitated the development of a considered, well-designed project that will efficiently recover a highly valuable resource, while minimising environmental impacts and potential land use conflicts. The project has been assessed in accordance with the principles of ecologically sustainable development in order for it to be considered for approval.


Part H

References & Glossary



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Glossary

Adit: the entry to an underground mine which is horizontal or nearly horizontal, by which the mine can be entered, drained of water, ventilated, and minerals extracted.

Alluvium: unconsolidated sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on riverbeds, floodplains, and alluvial fans.

Ambient noise: the noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sounds dominate.

Amenity noise criteria: the amenity noise criteria relate to existing industrial noise. Where industrial noise approaches base amenity noise criteria, then noise levels from new industries need to demonstrate that they will not be an additional contributor to existing industrial noise.

Anion: an ion carrying a negative charge which moves towards the anode (positive electrode) during electrolysis.

Aquifer: rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water.

Arboreal: adapted for living and moving around in trees.

Assessment Background Level: a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{90} statistical noise levels.

Bank Cubic Metre (bcm): a cubic metre of rock or material in situ before it is extracted.

Basalt: a greenish- or brownish-black rock of compact texture and considerable hardness that is igneous in origin.

Battery Limit: A defined boundary between two areas of responsibility, which may be physical (eg a flange on a pipe) or represented by a geographical boundary or some other means.

Cation: an ion carrying a positive charge which moves towards the cathode (negative electrode) during electrolysis.

Core koala habitat: refers to areas of land with a resident population of koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population.

Curtilage: the curtilage of a house or dwelling is the land immediately surrounding it, ie attached to it, including any associated buildings or other structures.

Day period: Monday–Saturday: 7:00 am to 6:00 pm, on Sundays and public holidays: 8:00 am to 6:00 pm.

dBA: noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempt is to closely approximate the frequency response of the human ear.

Disturbance footprint: the area within the boundary of the proposed gold mining and processing operation.

Diurnal: of or during the day.

Drawdown: a lowering of the water table in an unconfined aquifer or the pressure surface of a confined aquifer caused by pumping of groundwater from bores and wells.

Dry sheep equivalent: a standard unit used to compare the feed requirements of classes of livestock and to assess the carrying capacity of a farm or paddock.

Ephemeral: lasting a very short time; short-lived; transitory.

Evening period: Monday–Saturday: 6:00 pm to 10:00 pm, on Sundays and public holidays: 6:00 pm to 10:00 pm.

Full time equivalent: a unit used to indicate the hours worked by one employee on a full-time basis.

Gypsum: a soft white or grey mineral consisting of hydrated calcium sulphate.

Intrusive noise level: refers to noise that intrudes above the background level by more than 5 dB.

Liquefaction: refers to when saturated or partially saturated soil (or tailings) loses strength and stiffness in response to an applied stress or other sudden change in stress condition.

LA10: A noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels

LA90: Commonly referred to as the background noise, this is the level exceeded 90% of the time

LAeq: The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period

LAmax: The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval

L_{eq}: the energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The $L_{eq\ (15min)}$ descriptor refers to an L_{eq} noise level measured over a 15 minute period.

L_{max}: the maximum sound pressure level received during a measuring interval.

Locality Area: located within 20 kilometres radius from the project area

Longwall: noting or pertaining to a means of extracting coal or other minerals in an underground mine from a continuous face, the roof at the face being supported at intervals by temporary or movable artificial supports which allow the roof to collapse and form a goaf behind the face.

Metasediment: sediment or sedimentary rock that appears to have been altered by metamorphism.

Net present value: The net present value is the sum of a series of net cashflows, discounted over time to reflect the time-value of money. The discount rate used should reflect the utility value of money to the individual or group of individuals to whom the costs and or benefits will accrue.

Night period: Monday–Saturday: 10:00 pm to 7:00 am, on Sundays and public holidays: 10:00 pm to 8:00 am.

Olivine: a magnesium iron silicate; common mineral in the Earth's subsurface; weathers quickly on the surface.

Opportunity cost: the true cost of something is what you give up to get it. This includes not only the money spent in buying (or doing) the something, but also the economic benefits that you did without because you bought (or did) that particular something and thus can no longer buy (or do) something else.

Overburden: the overlying rock, clay, etc., above the mineral of economic interest. In open cut mining this is the material that must be removed to access the mineral deposit.

Permeability: the property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature.

Perennial: lasting for an indefinitely long time; enduring. A perennial stream is one that has continuous flow in parts of its stream bed all year round during years of normal rainfall.

Piezometer: an instrument for measuring the pressure of a liquid or gas, or something related to pressure (such as the compressibility of liquid).

Porosity: the proportion of open space within an aquifer, comprised of intergranular space, pores, vesicles and fractures.

Potential koala habitat: refers to areas to native vegetation where the trees of the types listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Project noise trigger level: criteria for a particular industrial noise source or industry. The PNTL is the lower of either the intrusive level or amenity level.

Rating background level (RBL): an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness level (or criteria) for noise assessment purposes and is the median of the average background levels.

Recharge: the process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the water table or exposed aquifers. It is the addition of water to an aquifer.

Recharge area: a geographic area that directly receives infiltrated water from surface and in which there are downward components of hydraulic head in the aquifer. Recharge generally moves downward from the water table into the deeper parts of an aquifer then moves laterally and vertically to recharge other parts of the aquifer or deeper aquifer zones.

Sclerophyll: a type of vegetation that has hard leaves, short internodes (the distance between leaves along the stem) and leaf orientation parallel or oblique to direct sunlight.

Shale: an argillaceous fissile rock, the laminae of which are usually fragile and uneven, and mostly parallel to the bedding; often overlying a coal formation.

Sound power level (L_W): a measure of the total power radiated by a source (eg a piece of equipment such as a truck or excavator). The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.

Stratigraphy: the branch of geology that is concerned with the order and relative position of the strata of the earth's crust.

Stygofauna: the animals that live in groundwater. Predominantly comprise many kinds of crustaceans but includes worms, snails, insects, other invertebrate groups, and, in Australia, two species of blind fish.

Subsidence: sinking or gradual downward settling of the ground's surface.

Tailings: a combination of the fine-grained solid material remaining after the recoverable metals and minerals have been extracted from crushed and ground mined ore, and any process water remaining.

Temperature inversion: a meteorological condition where the atmospheric temperature increases with altitude.

The project: The proposed gold mining and processing operation known as McPhillamys Gold Project

Transect: a straight line or narrow section through an object or natural feature or across the earth's surface, along which observations are made or measurements taken.

Water table: the top of an unconfined aquifer. It is at atmospheric pressure and indicates the level below which soil and rock are saturated with water.

Acronyms

AAQM	Ambient air quality measure
ABL	Assessment Background Level
ABS	Australian Bureau of Statistics
ACHA	Aboriginal cultural heritage assessment
ACHMP	Aboriginal cultural heritage management plan
ADW	Australian Drinking Water
AEP	Annual exceedance probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AIP	Aquifer Interference Policy
AIS	Agricultural Impact Statement
ANE	Ammonium nitrate emulsion
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZMEC	Australian and New Zealand Minerals and Energy Council
APZ	Asset Protection Zone
ARI	Average recurrence interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASC	Australian Soil Classification
ASL	Above Sea Level
ASS	Acid sulfate soil
BAM	Biodiversity assessment method
BAR	Biodiversity assessment report

BC Act	NSW *Biodiversity Conservation Act 2016*
BCD	Biodiversity and Conservation Division of the Department of Planning, Industry and Environment
bcm	Bank cubic metres
BDAR	Biodiversity development assessment report
bgl	Below ground level
BHPG	Belubula Head Waters Protection Group
BoM	Bureau of Meteorology
BOS	Biodiversity offset scheme
BSAL	Biophysical strategic agricultural land
CBA	Cost benefit analysis
CCC	Community Consultative Committee
CEEC	Critically endangered ecological community
CEMP	Construction Environmental Management Plan
CIC	Critical industry cluster
CIL	Carbon in leach
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTMP	Construction Traffic Management Plan
CWF	Clean water facility
DA	Development application
Dams Safety Act	NSW *Dams Safety Act 1978*
DSC	Dans Safety Committee
dB(Z), dB(L)	Decibels Z-weighted (Z) or linear (L)
DEC	NSW Department of Environment and Conservation (former)
DoEE	Commonwealth Department of the Environment and Energy

DPE	NSW Department of Planning and Environment (now DPIE)
DPIE	NW Department of Planning, Industry and Environment
DPI	NSW Department of Primary Industries
DoI Water	NSW Department of Industry – Water
DRE	NSW Division of Resources and Energy
Drinking Water SEPP	*State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*
DSC	Dams Safety Committee
EA	Energy Australia
EARs	Environmental assessment requirements
EC	Electrical conductivity
EEC	Endangered ecological community
EIS	Environmental impact statement
EL	Exploration licence
EMM	EMM Consulting Pty Limited
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW *Environmental Planning and Assessment Regulation 2000*
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental planning instrument
EPL	Environment protection licence
ERP	Emergency response plan
ESD	Ecologically sustainable development
FBA	Framework for Biodiversity Assessment
FDI	Fire Danger Index

FEL	Front end loader
FM Act	NSW *Fisheries Management Act 1994*
Forestry Act	NSW *Forestry Act 2012*
FoS	Factor of Safety
FRNSW	Fire and Rescue NSW
FTE	Full time equivalent
GADDC	Guidance on the Assessment of Dust from Demolition and Construction
GDE	Groundwater dependent ecosystem
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Geographic information system
GOS	Gross operating surplus
Heritage Act	NSW *Heritage Act 1977*
Hz	Hertz
IBRA	Interim Biogeographic Regionalisation of Australia
ICNG	Interim Construction Noise Guideline
Interim Protocol	Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land
IPC	Independent Planning Commission
JORC	Joint Ore Reserve Committee
K	Hydraulic conductivity
kg	Kilograms
kPa	Kilopascal
kV	Kilovolts
LEA	Local effects analysis

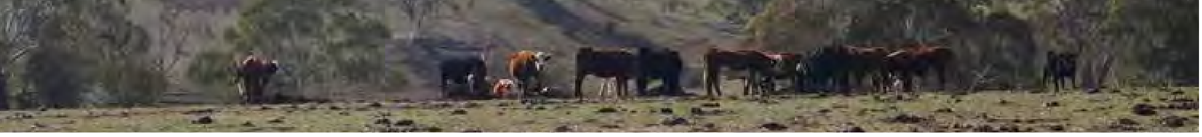
LEP	Local environmental plan
LGA	Local government area
Local Government Act	NSW *Local Government Act 1993*
LoS	Level of service
LPG	Liquefied petroleum gas
LSC	Land and soil capability
Mbcm	million bank cubic metres
mbgl	Metres below ground level
MDB	Murry Darling Basin
mg	Milligrams
MIC	Maximum instantaneous charge
Mining Act	NSW *Mining Act 1992*
Mining SEPP	*State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
ML	Megalitres
MLA	Mining Lease Application
mm	Millimetres
MNES	Matter of national environmental significance
MOP	Mining operations plan
MPa	Megapascal
MPPS	Energy Australia's Mount Piper Power Station
Mt	Million tonnes
Mtce	Metric tonnes carbon equivalent
Mtpa	Million tonnes per annum
MW	Megawatts

NAF	Non-acid forming
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measures
NGAF	National Greenhouse Accounts Factors
NGERS Act	Commonwealth *National Greenhouse and Energy Reporting Act 2007*
NML	Noise management level
NMP	Noise management plan
NPfI	NSW Noise Policy for Industry
NPI	National Pollutant Inventory
NPV	Net present value
NPW Act	NSW *National Parks and Wildlife Act 1974*
NVA	Noise and Vibration Assessment
OEH	Office of Environment and Heritage, now the Biodiversity and Conservation Division of the Department of Planning, Industry and Environment (BCD)
OEMP	Operational environmental management plan
oz	ounces
PAA	Primary assessment area used for the social impact assessment
PAD	Potential archaeological deposit
PAF	Potentially Acid Forming
PCT	Plant community type
PEA	Preliminary Environmental Assessment
PHA	Preliminary hazard analysis
Pipelines Act	NSW *Pipelines Act 1967*
PM	Particulate matter
PM_{10}	Fine particulate matter 10 microns in diameter or less

$PM_{2.5}$	Fine particulate matter 2.5 microns in diameter or less
PMST	Protected Matters Search Tool
POEO Act	NSW *Protection of the Environment Operations Act 1997*
ppm	Parts per million
PPV	Peak particle velocity
PNTL	Project noise trigger level
PVC	Primary view catchment
RAA	Regional assessment area
RAP	Registered Aboriginal party
RBL	Rating Background Level
Regis	Regis Resources Ltd
RFS	NSW Rural Fire Service
RMS	NSW Roads and Maritime Services
RNP	Road Noise Policy
Roads Act	NSW *Roads Act 1993*
ROM	Run of mine
RTS	Response to submissions
Rural Fires Act	NSW *Rural Fires Act 1997*
SAA	Secondary Assessment Area (used in the social assessment)
SAL	Strategic agricultural land
SB	Stormwater basin
SCSO	Centennial Coal's Springvale Coal Services Operations
SEPP	State Environmental Planning Policy
SEPP 33	*State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*

SEPP 44	*State Environmental Planning Policy No. 44 – Koala Habitat Protection*
SEPP 55	*State Environmental Planning Policy No 55 – Remediation of Land*
SH	State highway
SHR	State Heritage Register
SIA	Social impact assessment
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SRLUP	Strategic Regional Land Use Policy
SSD	State significant development
STP	Sewage treatment plant
SVC	Site verification certificate
TAFE	Technical and Further Education
TAMP	The air model pollution
TDS	Total dissolved solids
TEC	Threatened ecological community
TEOM	Tapered element oscillating microbalance
TfNSW	Transport for NSW
TN	Total nitrogen
TP	Total phosphorus
tph	Tonnes per hour
TSP	Total suspended particles
TSF	Tailings storage facility
TSS	Total suspended solids
VIA	Visual impact assessment
VLAMP	Voluntary Land Acquisition and Mitigation Policy

VOC	Volatile organic compound
VPA	Voluntary planning agreement
WAD	Weak acid dissociable
WAL	Water Access Licence
Water Act	NSW *Water Act 1912*
WHO	World Health Organisation
WM Act	NSW *Water Management Act 2000*
WMF	Water management facility (dam)
WMP	Water management plan
WSP	Water sharing plan
WWTP	Waste Water Treatment Plant



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