CHAPTER 11

Site Setting

1. Environmental Setting

1.1 REGIONAL AND LOCAL SETTING

The Hazelwood Rehabilitation Project is located in the Latrobe Valley, nestled between the Strzelecki Ranges to the south and the Baw Baw Ranges, part of the Great Dividing Range, to the north.

Primary urban centres within the Latrobe Valley include Moe, Morwell, and Traralgon, with smaller towns including Churchill, Yinnar, Glengarry, and Tyers. The population of the Latrobe Valley is approximately 77,000 people (*2021 Census data*). The valley is known for its diverse lifestyle options, including urban living, rural townships, and bush settings, supported by good schools and hospitals.

In addition to hosting one of the largest brown coal reserves in the world, the Latrobe Valley also has a significant forestry industry, food processing, engineering, education, retail, and aviation sectors.

The land uses immediately surrounding MIN5004 consist of:

- agricultural land and pine plantations to the west of the mine;
- farming land to the south-east;
- industrial land on the eastern side; and
- the Morwell township, commercial and public land to the north.

The site is bound by the Princes Highway to the north, the Strzelecki Highway on the west, Brodribb Road and Yinnar Road to the south-eastern side and the Monash Highway to the east.

1.2 LATROBE PLANNING SCHEME

The Hazelwood Rehabilitation Project and its surrounds are subject to the Latrobe Planning Scheme (DELWP 2019). The MIN5004 area is predominately within Special Use Zone 1 (SUZ1) which provides buffer zones for coal mining, electricity generation, and associated uses to minimise the potential for land use conflict.

The MIN5004 area is also subject to the following Latrobe planning scheme overlays:

- Land subject to inundation;
- Bushfire management;
- Floodway;
- Road closure;
- Schedule 1 to design and development; and
- Schedule 1 to environmental significance.

There are some key land assets that were mine and power station related, however, do not reside on the mining licence. The Hazelwood Cooling Pond and the power block (former site of the power station) are outside the mine licence area. Nonetheless, the cooling pond is the subject of current EES approvals and will feature in a Planning Scheme Amendment as part of the EES approval process.

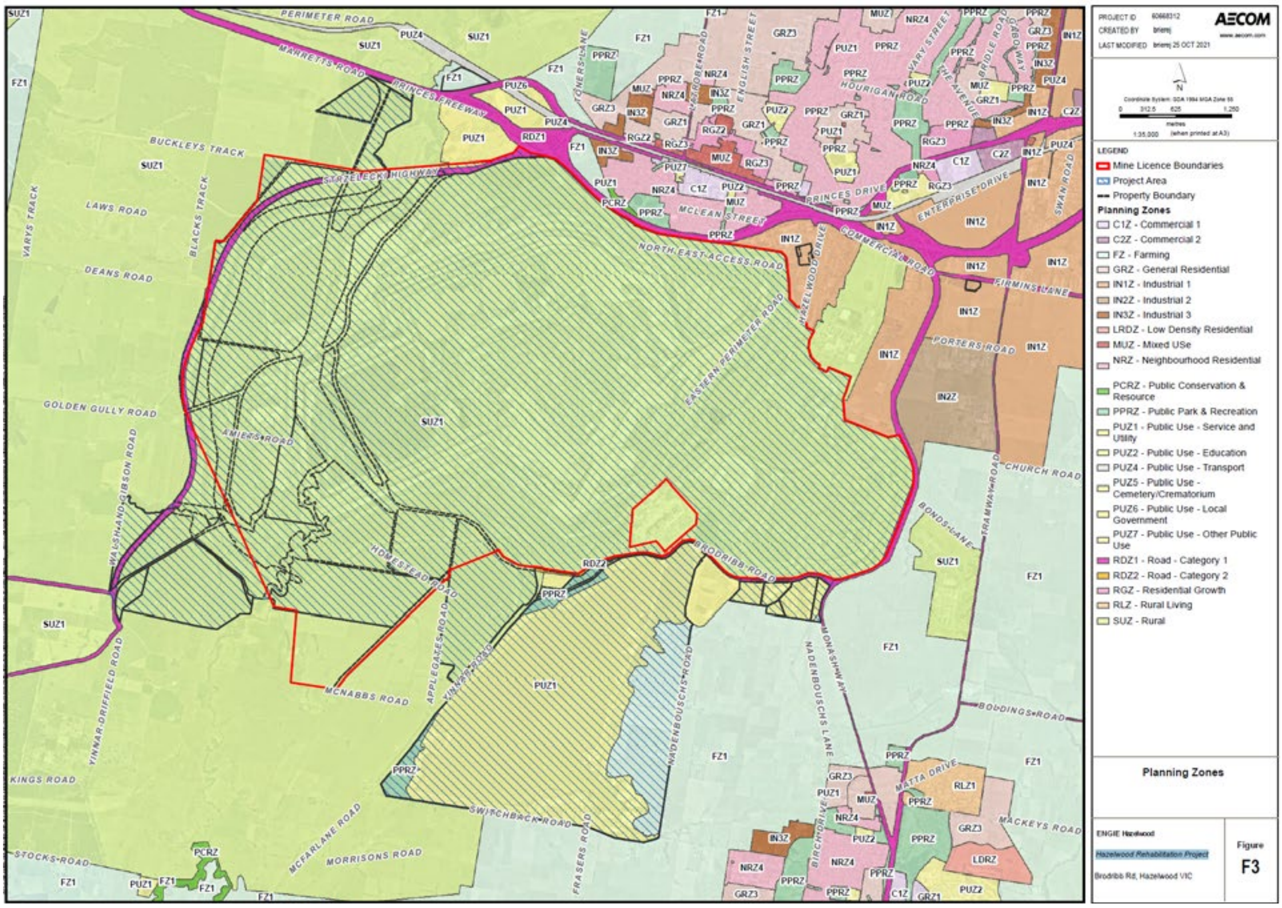

Figure 11.1: Hazelwood Rehabilitation Project – Planning zones

1.3 COMMUNITY SETTING

The main townships located close to the MIN5004 area are the townships of Morwell which is immediately north and Churchill which is approximately 2 km away in a south-easterly direction. Moe and Newborough are located approximately 12 km to the northwest of the site with Traralgon located approximately 12 km to the north-east.

The towns of Morwell, Churchill, Yallourn, Moe, and Newborough were initially established primarily to service the power industry, with housing built for electricity industry workers. The workforce that was directly engaged in the electricity, gas and water supply industry was significantly reduced during the 1980s and 1990s when the SECV assets involving the coal mines, electricity generation operations and transmission assets were sold to a number of private entities.

2. Climate

2.1 REGIONAL CLIMATE

The climate of the Latrobe Valley is described as temperate, with cool to warm summers and mild to cool winters. The long-term mean rainfall at the Yinnar Met station is 832 mm, with August generally the wettest month with a long term mean rainfall of 88.7 mm and February the driest month, with a long-term mean rainfall of 43.5 mm respectively. The mean evaporation rate is 1,227 mm per year with the mean monthly evaporation rate exceeding the mean monthly rainfall over the spring / summer months (September through to April). In contrast, rainfall exceeds the mean evaporation rates of the winter / autumn months (May through to August).

The Moe weather station is located approximately 21 km from the MIN5004 area, while the Morwell weather station is approximately 9.5 km away.

2.2 FUTURE CLIMATE PROJECTIONS

In conjunction with the CSIRO, the Australian Government, Department of the Environment and Energy, Bureau of Meteorology and Climate Change in Australia (CSIRO et al 2018) broad scale climate change projections for Australia's natural resource management boundaries have been developed. In terms of categorisation, Hazelwood falls into the Southern Slopes cluster, Victoria East sub-cluster. On a regional scale key messages have been developed relating to general projections which the CSIRO et al (2018) have identified (with a high confidence) to occur in this specific sub-cluster in the future. These are:

- average temperatures will continue to increase in all seasons;
- more hot days and warm spells are projected with fewer frosts;
- generally, less rainfall in the cool season;
- increased intensity of extreme rainfall events; and
- a harsher fire-weather climate in the future.

Changes to summer and autumn rainfall are possible but less clear. For the near future (2030), natural variability is projected to dominate any projected changes.

Maximum temperatures in Gippsland are expected to show a median increase of 1.2°C by the 2030s (2020-2039) (DELWP CSIRO 2019). However, this is under a high emissions scenario and the amount of further increase in the second half of the century depends on the world's greenhouse gas emissions over the coming decades.

Gippsland's rainfall is naturally variable, and this natural variability will dominate the rainfall over the next decade or so (DELWP CSIRO 2019). Over time, annual rainfall totals are likely to decline, particularly under the high emissions scenario, with the greatest drying in spring. By late century under high emissions scenarios, the climate trend becomes obvious compared to natural variability with a medium of 15% decrease in annual rainfall totals, and larger anticipated decreases (29%) in spring (DELWP CSIRO 2019).

3. Description of natural disasters history and environmental pressures

3.1 FIRE

The project area is situated within a designated bushfire prone area and the bushfire management overlay applies to small sections of land within the perimeter of the project area boundary and within the broader study area (Figure 11.1). Mine fire is a significant risk across the Latrobe Valley mining industry, with an extreme fire risk associated directly with the exposed coal face of brown coal mines.

The Latrobe Valley has experienced significant fire events in documented history which have shaped the landscape and affected Communities. Of most relevant was the Hazelwood mine fire in 2014 in which embers from nearby grassfires ignited the worked-out coal mine, resulting in a fire that burned for 45 days.

In addition to the Hazelwood mine fire, the following natural fire events are also notable:

- Black Friday (1939): One of the most devastating bushfires in Australian history, it burned nearly 2 million hectares across Victoria, including parts of Gippsland.
- Ash Wednesday (1983): This series of fires affected multiple states, including Victoria, where Gippsland saw significant damage. The fires resulted in 75 deaths and widespread destruction.
- 2003 Alpine Fires: Lightning ignited 87 fires in the North-East and East Gippsland regions, burning for weeks and causing extensive damage.
- 2006 Moondarra Fire: A deliberately lit fire in Moondarra State Park, northeast of Moe, burned significant areas of bushland.
- 2009 Black Saturday: Among the deadliest bushfires in Australian history, these fires ravaged Victoria, including parts of Gippsland, resulting in 173 deaths and massive property loss.
- 2012-2013 Aberfeldy Fires: Ignited in bushland near Aberfeldy, these fires spread rapidly, burning large areas and causing significant damage.

These events highlight the region's past and future vulnerability to bushfires, driven by its fire-prone environment and climatic conditions.

Fire risk is managed within the project area in accordance with ENGIE Hazelwood's fire risk management plan (*Appendix G*) and a range of other operational fire management policies and procedures.

Surrounding land uses, including farming, tree plantations, and regional communities are serviced by the Country Fire Authority (CFA) with brigades located at Churchill, Hazelwood North, Morwell, and Thorpdale.

3.2 FLOOD

The surface water catchment of the Latrobe Valley is primarily centred around the Latrobe River system, which originates on the Baw Baw Plateau and flows through the valley before emptying into Lake Wellington. Key water sources in the catchment include the Latrobe River and its tributaries, such as the Tanjil and Tyers Rivers. Major water storages in the region include the Blue Rock Reservoir, Moondarra Reservoir, and Lake Narracan.

The Latrobe Valley has a history of significant natural flooding events, primarily influenced by the Latrobe River and its tributaries. Major floods have been recorded since the 1840s, with one of the most severe occurring in December 1934. This flood had an estimated peak discharge of 3,115 cubic meters per second, causing widespread inundation and damage. Subsequent floods in the region have often been exacerbated by changes in land use and river channel modifications. For instance, channelization and engineering works on the Latrobe River have altered its natural flow, reducing the frequency of minor floods but sometimes intensifying the impact of major floods.

More recent floods, such as those in 2011 and 2012, have continued to challenge local communities and highlight the ongoing need for effective flood management and mitigation strategies. The proposed interconnection of the pit lake at Hazelwood with the Morwell River will go some way toward mitigating the impacts of future natural flood events.

Hazelwood sits within the historical Morwell River floodplain. During pre-mining periods, the floodplain was extensive, and the river would swell and expand across large farmland areas. As part of the Hazelwood mine development the Morwell River was diverted to prevent the mine void from flooding. The diversion resulted in reduced floodplain capacity and increased the flow rate towards the Latrobe River during wet periods.

3.3 GEOTECHNICAL STABILITY

Mining of the Latrobe Valley's brown coal resources for over a century has created geotechnical challenges for the mining operations and impacts on the surrounding land. The region's geology includes thick layers of soft, compressible brown coal, interspersed and overlaid with clay and sand layers and underlaid with regional scale confined aquifers. This composition of strata and the geological structures make the area prone to ground movements such as subsidence, sinkholes, and floor heave, particularly in and around the coal mines.

The Latrobe region periodically experiences seismic activity, with recent earthquakes recorded in the nearby Strzelecki Ranges, such as the magnitude 4.5 earthquake near Leongatha in February 2024. These events highlight the presence of active fault lines and the potential for ongoing seismic activity.

Notable incidents include the Yallourn Northern Batters failure in 2007 and the Hazelwood Mine wall movement in 2011. These events underscore the need for careful geotechnical monitoring and management to mitigate risks associated with both natural and human-induced ground movements.

The geotechnical characteristics of the site are described in significant detail in Section 6.

3.4 TOPOGRAPHY

Hazelwood Mine is located within the catchment of the Morwell River. The pre-mining elevation was defined using land and aerial surveys between 1940 and 1970 with the regional topography consisting of:

- a relatively flat landscape to the east of the site ranging between RL +80 m AHD to +100 m AHD;
- a gradual rise in elevation to RL +100 m AHD south of the site along the river valley;
- becoming steeper approximately 13 km from the mine towards the Strzelecki Ranges; and
- the area to the west of the mine and the Morwell River along the slopes of the Haunted Hills Formation are defined by higher elevations, with elevations reaching RL +300 m AHD.

Prior to mining activities, the elevation of Hazelwood Mine typically ranged from RL +50 m AHD to RL +60 m AHD with a gentle rise in elevation towards the ridge located to the south-east of the site (Figure 11.2).

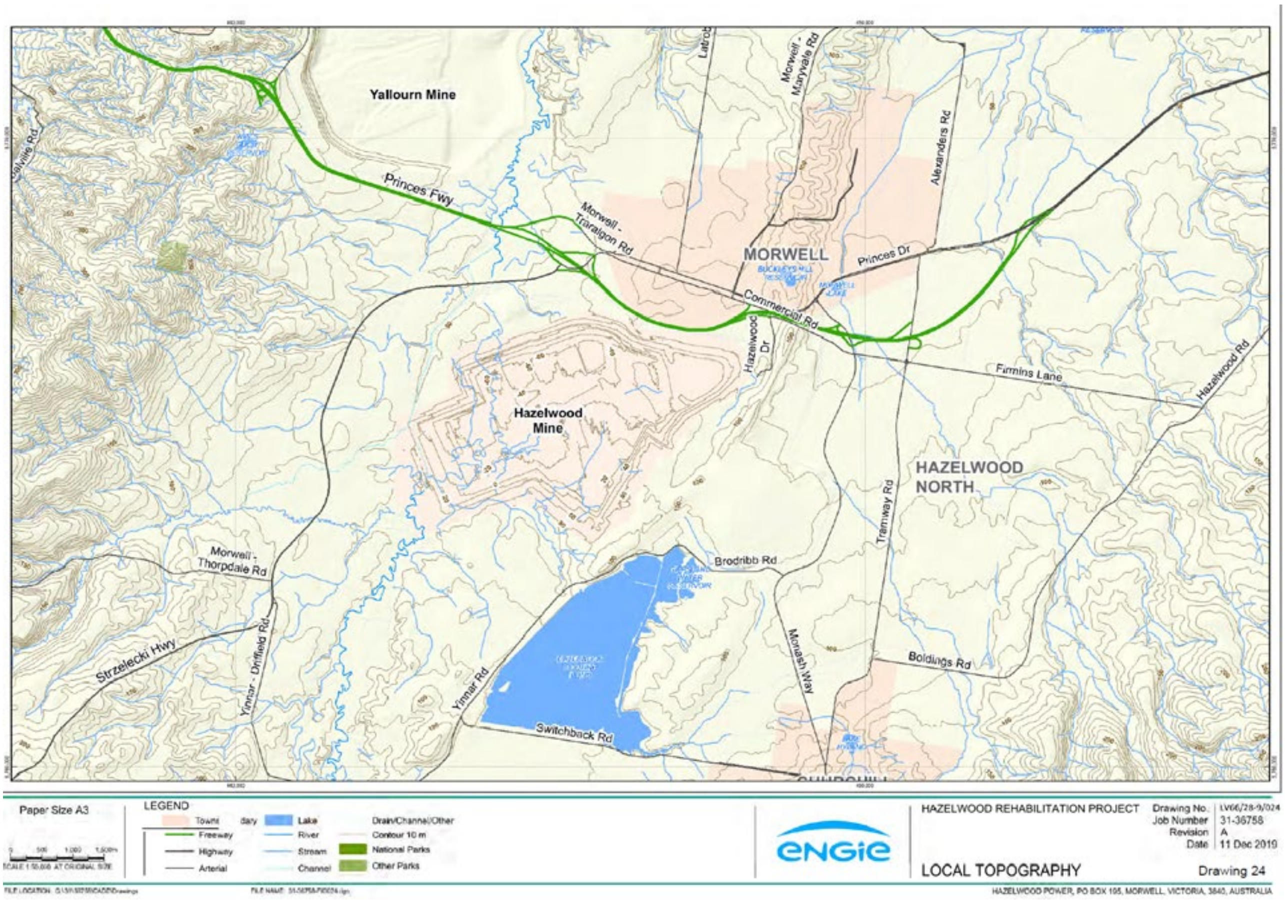

Figure 11.2: Local topography

4. Dominant soils and land capability

4.1 SOIL CHARACTERISTICS

A baseline soil survey was undertaken in 2004 as part of the EES for the Hazelwood Mine West Field Project area (Enesar Consulting, 2004). The study characterised the dominant soils within the MIN5004 area prior to mining. The soils were generally fine-grained and clay rich, with a minor sand component that increases to the west of the site.

Four major regolith types were recognised:

- Lower hillslopes: predominantly sand and clay, cemented in areas by iron and silica. Found in areas of higher elevation (i.e. crests and upper slopes) and are a product of weathering of poorly consolidated sediments of the Haunted Hills Formation;
- Alluvial and colluvial fans: fine, clay dominated material with a lower sand content. Present on the lower slopes and at the mouths of drainage lines;
- Terraces: fine, silty clay and clay with occasional sand lenses, formed by fluvial activity within the floodplains which formed terraces above the flood level; and
- Active floodplains: clay dominated material showing minimal soil development aside from organic topsoil and some mottling and blocky structures present below the topsoil. Formed as part of the fluvial material of the modern floodplains including the beds and banks of watercourses.

The survey provided information on soil characteristics within the MIN5004 area. Key findings were:

- sandy silts and clayey silts are present at 0 – 1.2 m below ground level;
- an increase in sand content with depth is observed from 2.8 – 5.8 m below ground level;
- alkalinity showed a minor increase with depth;
- soil salinity was generally below levels that would affect plant growth; and
- depth to coal ranged between 7.4 to 19.1 m below ground level within the survey area.

Further soil sampling was undertaken during a land use suitability assessment (Landloch 2019a). This sampling program undertook soil observations and sampling at Hazelwood at a density of 1 per 20 ha to 100 ha. Both rehabilitated and undisturbed areas were sampled, with topsoil and subsoils collected at each location. All samples were sent to a NATA accredited laboratory. A variety of agronomic and physical parameters were tested for, with soil erosion and infiltration characteristics measured on rehabilitated areas using a rainfall simulator and double ring infiltrometer. Sampling for this project revealed a very similar chemistry to historic sampling.

4.2 TOPSOIL INVENTORY

Hazelwood Mine maintains a topsoil inventory through topsoil stockpile areas as shown in Figure 11.3. Topsoil management has been informed by investigations of topsoil quality, quantities and stripping depth recommendations.

During the initial periods of mining, soil (topsoil and overburden) was removed and placed in the overburden dumps. In more recent times topsoil has been stripped and separated from overburden to be used in the rehabilitation of mining areas. Topsoil is typically placed on reprofiled landforms for mine rehabilitation at an approximate depth of 20 cm. Topsoil stockpiles generally do not exceed 2m in height to protect from erosion, maintain biological activity and soil structure.

ENGIE Hazelwood has identified enough available topsoil to complete rehabilitation activities to achieve the full pit lake scenarios, however to achieve suitable capping requirements in accordance with the EPA Landfill Licensing Guidelines (EPA 2016), additional topsoil is needed.

In response ENGIE Hazelwood is:

- utilising other suitable on-site materials such as subsoil; and
- sourcing alternative options for external sources of topsoil.

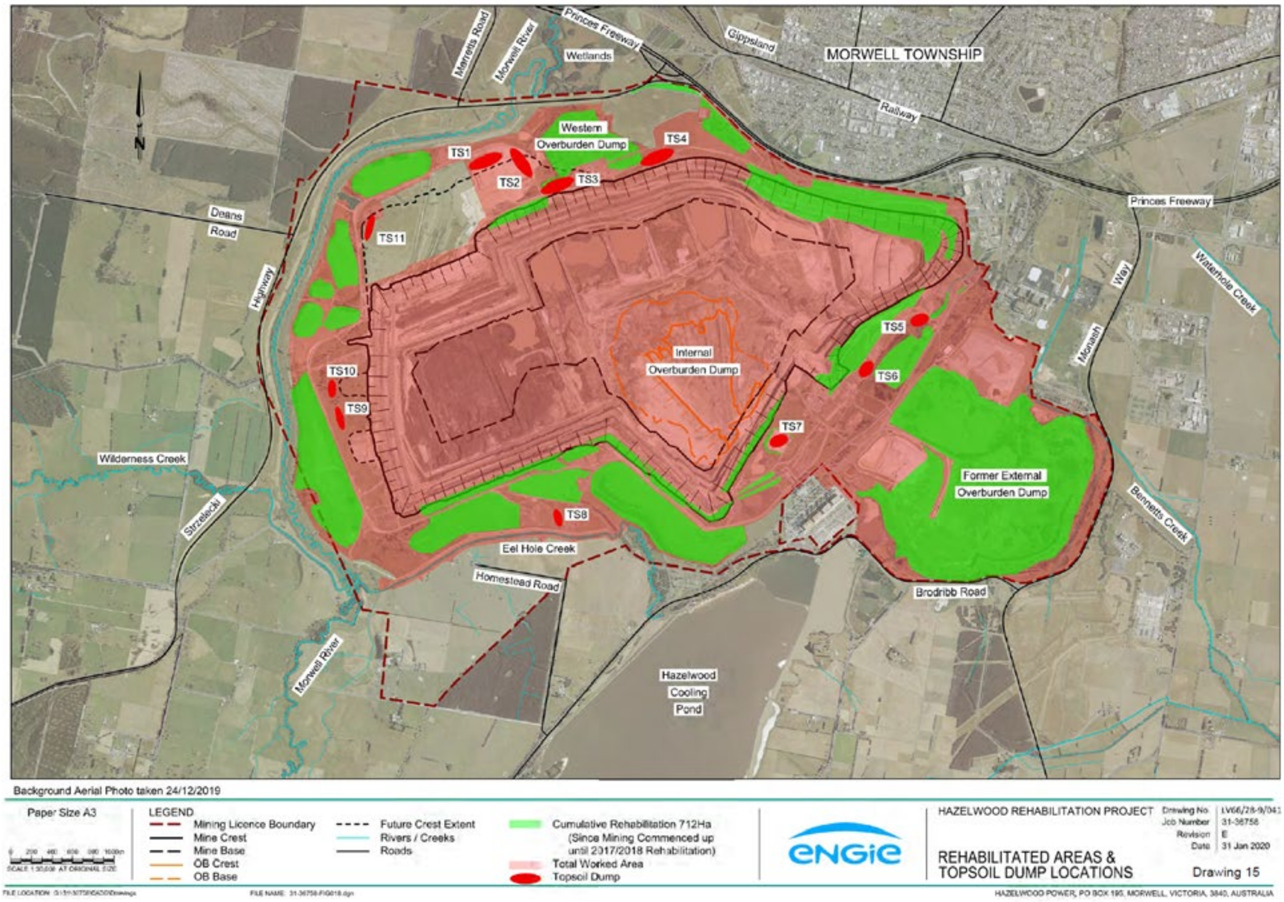

Figure 11.3: Rehabilitation Areas and Topsoil Dump Locations

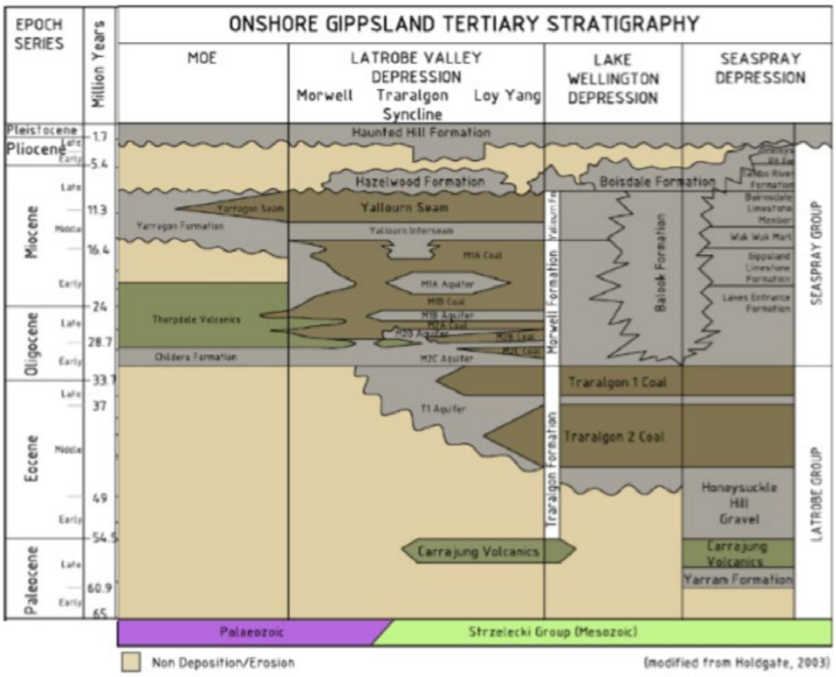

Figure 11.4: Stratigraphy of the Latrobe Valley Depression within the Onshore Gippsland Region

5. Geology

5.1 REGIONAL STRATIGRAPHY

The Gippsland sedimentary basin is one of the major coal and oil producing provinces in the world and is divided into several sub-basins. Hazelwood is located within the Latrobe Valley depression, within the western portion of the Gippsland Basin. Figure 11.4 presents the stratigraphy of the Latrobe Valley depression within the onshore Gippsland region.

The Latrobe Valley depression is a major feature in the regional geological setting. It comprises complex fault systems, which bound the northern and southern platforms and terraces within the depression. Major folding has resulted in the formation of monocline structures.

Traditionally, structural features of the depression have been represented within the higher Cenozoic strata. Three main lignite bearing formations have been identified within the Latrobe Valley depression, these are:

- Traralgon Formation (Eocene Age, 37 to 53 million years),
- Morwell Formation (Oligocene and early Miocene Age, 15 to 37 million years), and
- Yallourn Formation (mid-Miocene Age, 5 to 11 million years).

There are also deeper underlying structures including two key features that have been shown to influence the coal strata (i.e. the Yallourn and Morwell deep basement faults), which are located below the Yallourn and Morwell monoclines (Figure 11.5). The individual coal seams are identified by their formation and depth within the sequence (e.g. M1 is the shallowest coal seam within the Morwell Formation) and the non-coal materials between seams (interseams) are named according to the overlying coal seam (e.g. M1 interseam underlies the M1 coal seam).

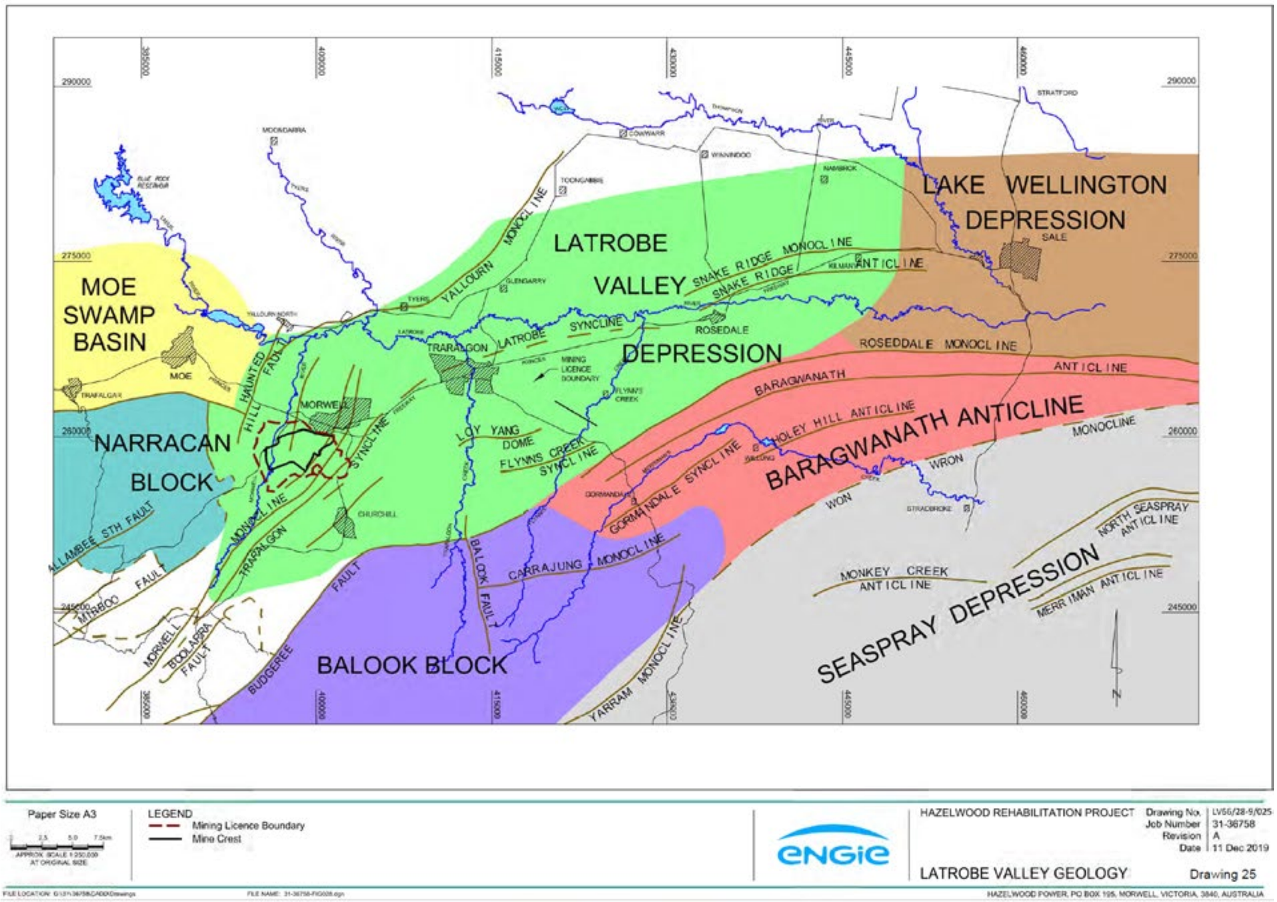

Figure 11.5: Latrobe valley geology

The Morwell formation is a complex unit typically consisting of thick coal seams and lesser clay-sand sequences. The Morwell formation includes the Morwell 2, Morwell 1B and Morwell 1A coal seams, which locally split or merge depending on their location relative to the major coal deposition centres. The oldest seam, Morwell 2, at Hazelwood is overlain by the younger, coal-poor Morwell formation units and the Yallourn formation. The Morwell 1B seam conformably overlies the Morwell 2 seam, usually with an interseam separation of clay and minor sand varying between 2 and 30 m.

The Morwell 1B and overlying Morwell 1A seams combine in the Morwell-Driffield area to form up to 230 m of continuous, low ash coal.

The interseams generally comprise sands, silts and clays, hence may contain local and regional scale aquifers depending on the extent and hydraulic properties of these materials. Remnants of volcanic activity within the basin are present through interbedding of the Thorpdale volcanics within the Morwell formation sediments, particularly throughout the western section of the Latrobe Valley depression.

5.2 LOCATION STRATIGRAPHY

The local stratigraphy at Hazelwood is characterised by six stratigraphic units which the mine and associated mining activities historically interacted with. From shallow to deep they include:

- Overburden sediments. Typically, 9 m to 16 m thick and clayey silt of the Haunted Hills Formation. A prominent geological feature of the Morwell area is the presence of deep “craters” (fire-holes) that have been burned into the top of the Morwell No.1 (M1) seam and subsequently filled with overburden material up to 50m in thickness.
- Morwell No. 1 (M1) coal seam. Consists of adjoining M1A and M1B coal seams, with a maximum thickness of approximately 165 m just north of the open cut under Morwell township, while at the southern margin of the East Field, its thickness has been reduced, mainly through erosion to 80 m. The seam is continuous except for a thin clay parting, confined to the east side of the open cut. Within the confines of the operating mine the thickness of the seam ranges from 135 m in the north to 50 m in the south.
- Morwell No. 1 (M1) clay seam. A weak clay layer underlying the M1 coal seam, ranging from 3 m to 15 m in thickness. This silty clay is normally underlain by a sandy aquifer of variable thickness and continuity, which is referred to in this report as the M1 aquifer.
- M1A Interseam. A sand and clay sequence made up of four discontinuous sand lenses that underlie the M1 Clay (M1A0 to M1A3 sands) and are interbedded with clay and silts. M1A3 is typically the thickest and most permeable lens. Thickness ranges approximately from 15 m to 25 m.
- Morwell 2 (M2) seam. This coal seam has a thickness of up to 55 m but was not mined at Hazelwood Mine.
- M2 Interseam. A clay stratum of variable thickness which contains one or more sand layers near the base of the M2 coal seam. Artesian water pressures have been encountered in these sand layers which are referred to as the M2 aquifer sands.
- Basement Strzelecki Group. Basal Tertiary conglomerate and lower cretaceous felspathic sandstone form the ‘basement’ in the vicinity of the Hazelwood Mine.

There are several structural features that influence the geology of the site as shown in Figure 11.6. The Morwell Monocline bounds the mine to the south-east and is steeply dipping. The monocline also trends north-east to south-west across the southeast and east fields. The Yallourn Syncline trends along the western boundary of the mine.

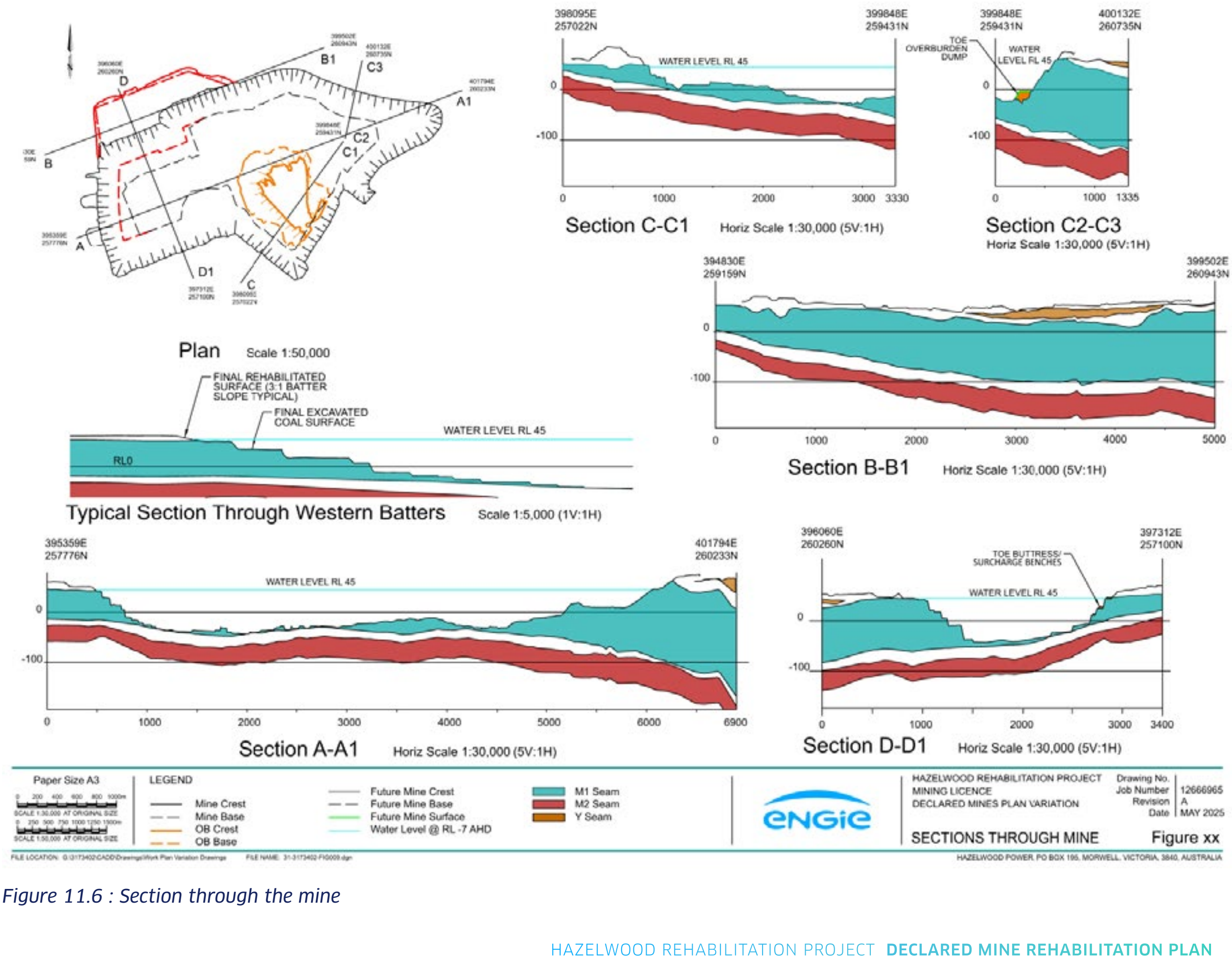

Figure 11.6 : Section through the mine

6. Geotechnical

The Hazelwood Mine void measures 6 km by 4 km at its longest and widest points and has been mined to a depth of between 70m and 130m. Overburden at the mine is generally less than 20m deep and development is to the full depth of the upper M1 coal seam which ranges from 50 m to 120 m thick within the open cut mine. In the immediate vicinity of the mine is the township of Morwell, the Princes Freeway, and infrastructure including the Morwell main drain (MMD) and transmission towers as well as other sensitive receptors.

Noting that the majority of the mine batters comprise M1 coal, the behaviour of the batters is influenced considerably by the geotechnical properties of the coal itself. The geotechnical properties of M1 coal (and brown coal in general) pose several challenges from a geotechnical perspective. Brown coal is a geotechnical 'transitional' material (i.e. hard soil/weak rock), has a low unit weight (11.2 kN/m3) meaning effective stresses are highly susceptible to pore water pressure changes, has a high moisture content and is highly compressible for a material having a 'strength' similar to a weak rock. These geotechnical properties and the mechanisms controlling mine batter behaviour: stress relief, groundwater induced subsidence/rebound, recharge of the groundwater system, creep behaviour during mine void filling and lake loading mean the behaviour of mine batters, and the analysis of their behaviour, is complex.

The mine has a shallow groundwater system and is underlain by three aquifer systems (the shallow groundwater system and the M1 and M2 aquifers). To maintain stability of the mine floor, mining operations over the past 60 years have required extensive dewatering, in particular from the deeper M2 aquifer. Extraction since the year 2000 has been in the range of 900 to 2,200 ML/year and 11,000 to 15,000 ML/year for the M1 and M2 aquifers respectively (Figure 11.6). This dewatering program is planned to continue until mine rehabilitation works are complete.

Underlying the Latrobe Valley is a sequence of Tertiary aged units (soil and weak rock units) that, in the vicinity of the mine, extend to depths in the order of 300m and deeper in other areas of the Latrobe Valley. Groundwater induced subsidence occurs due to stress changes causing compression in these Tertiary aged units. Dewatering of these aquifers has resulted in groundwater induced subsidence across large areas of the Latrobe Valley with subsidence of up to about 2.6m measured in the Morwell township. The majority of this ground movement occurred between the 1960s and 1980s when the main program of aquifer depressurisation was carried out.

7. Geochemical Characterisation

The geochemical properties vary throughout the landform within the MIN5004 area. Data has been collected throughout Hazelwood's operation to further understand the geochemical characteristics attributable to elements of the landscape. Such elements include material from within the mine void, overburden and the ash material produced as a result of burning the coal to generate power.

In 2018 a geochemistry review, completed by RGS (RGS, 2018a), gathered and reviewed existing available geochemical data at Hazelwood Mine, identifying data gaps and specifying the sampling and testing requirements to fill these data gaps. This technical study focused on gaining an understanding of the geochemistry of the site to further support the development of a conceptual model and final void / pit lake water balance and water quality model for Hazelwood Mine (RGS 2019b).

RGS (2018a) recognised at the time that there was generally limited or no geochemical testing data on the overburden material. However, based on the field visit and the limited data that was available it was expected that the presence of acid forming minerals (pyrite and marcasite) was likely to be very limited, with the bulk materials (coal ash, overburden and wall / floor coal) likely to be non-acid forming. Landloch, who assessed the chemical characteristics of topsoil and subsoil at Hazelwood Mine, also conducted linear shrinkage assessment on a range of overburden materials used as subsoil in rehabilitation (RGS 2019). Results from this analysis showed that linear shrinkage was low to medium for all samples, which indicates some tendency for soils to crack.

The coal at Hazelwood has the propensity to spontaneously combust, but only when it is loose (i.e. particle size is small). Specific historic geological formations disturbed through mining activities, known as "burn holes", are present at Hazelwood, which have in the past had the propensity to spontaneously combust. Burn hole depressions, being the area surrounding the burn hole, may be filled with weak, saturated material and are typically small areas (1 to 100s of metres long), but only 1 m to 5 m deep. Some of these burn holes were identified to be in existing and proposed reprofiled batters above RL +45 m AHD (Landloch 2019c). During the initial phase of batter profiling these areas were excavated and backfilled with clay to improve stability and remove the risk of future spontaneous combustion.

8. Hydrology

8.1 REGIONAL HYDROLOGY

Drainage in the Gippsland region is generally from the topographically elevated and strongly incised areas of the Great Dividing Range to the coastal strip and lake systems east of Sale (Figure 11.7). The main rivers in the West Gippsland region are the Latrobe River, Thomson River, Macalister River, and the Avon River. Surface water catchments associated with these rivers generally drain from west to east. The Thomson and Macalister Rivers join the Latrobe River in its lower reaches, around 10 km west of where it enters Lake Wellington, east of Sale. The Avon River, to the east, also drains into Lake Wellington and forms part of the 'lakes system' that connects to the ocean via Lakes Entrance in the far east of the Gippsland region. Gippsland Lakes are classed as estuarine. The flat, low-lying area around Sale and the lakes system are typically very swampy (GHD 2018a).

The Hazelwood mine is located in the Morwell River catchment, in and adjacent to the Morwell River floodplain. The Morwell River drains into the Latrobe River. Downstream of the Morwell River confluence, the Latrobe River flows through low-gradient land for some 60 km before discharging into Lake Wellington, which forms part of the Gippsland Lakes wetland system.

The Gippsland Lakes wetland system is recognised as a wetland of international importance under the Ramsar Convention (known as a 'Ramsar site'). The wetland was listed as a Ramsar site in 1982, qualifying by virtue of its habitat representativeness, flora and fauna conservation values, natural functioning, cultural heritage and other values. Lake Wellington is the most polluted of the three major lakes that comprise the wetland system, the other two being Lake Victoria and Lake King.

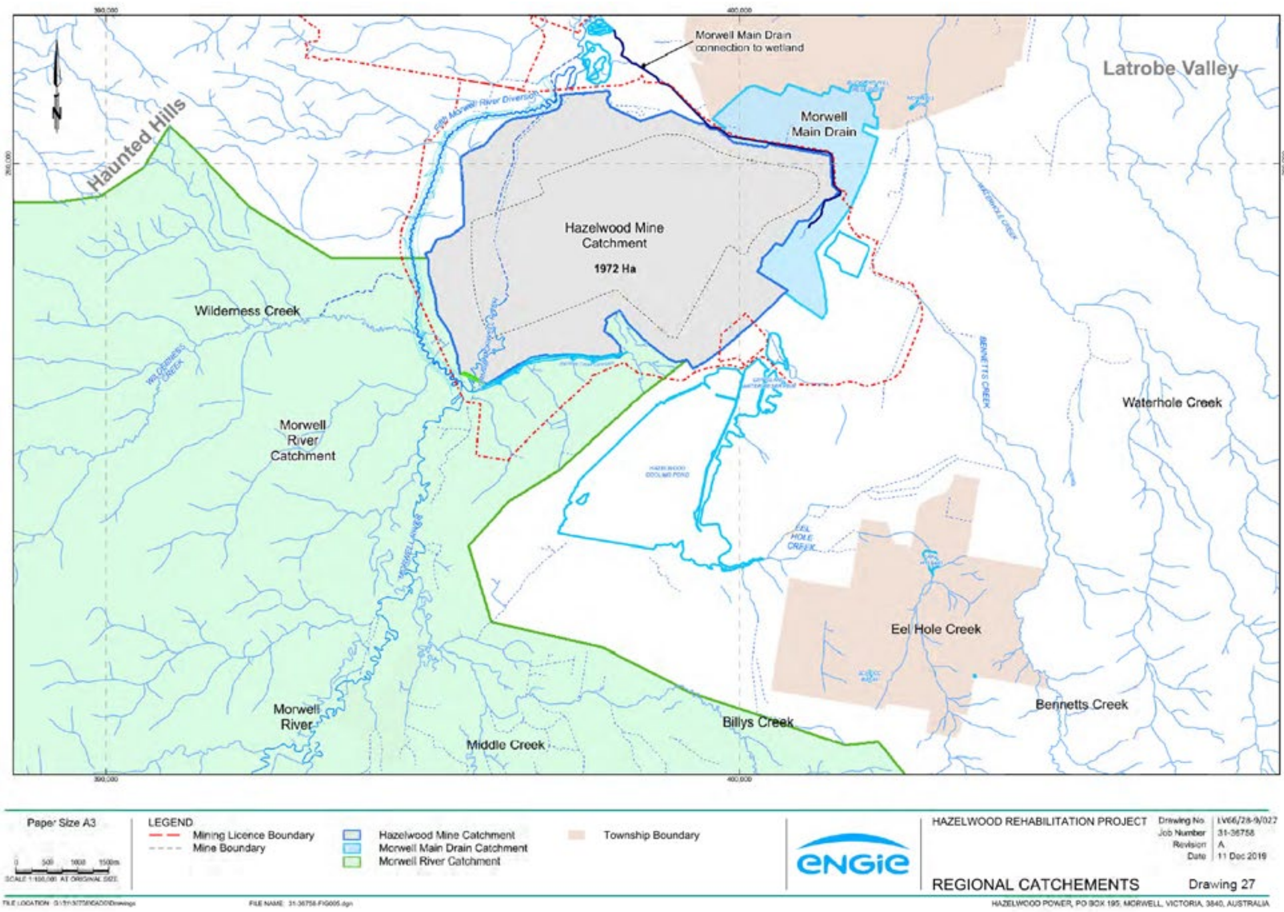

Figure 11.7: Regional river catchments – Hazelwood mine

8.2 LOCAL HYDROLOGY

The Morwell River is a key watercourse in proximity to Hazelwood. The Morwell River flows along the western boundary of the mine and has a catchment of approximately 650 m^2. In addition to the Morwell River the following creeks are also located adjacent to, or nearby, the site:

- Eel Hole Creek (approximately 1.5 km south east of the mine);
- Waterhole Creek (approximately 2 km north east of the mine and runs north-south);
- Bennetts Creek (located 1.5 km east of the mine but less than 100m east of the External Overburden Dump at its closest point);
- Wilderness Creek (approximately 2 km south west of the mine); and
- Deep marsh wetlands grouped together (north of the MIN5004 area).

The Morwell River and its tributary, Eel Hole Creek and Wilderness Creek, were previously realigned to allow access to the brown coal mined at Hazelwood and for flood protection.

There are two main waterways on the mining lease engineered as part of the Morwell River diversion; the Eel Hole Creek Diversion and the Morwell River Diversion (MMD). These waterways were created during the Morwell River re-location in the 2000s. Both are engineered diversions and both have been rehabilitated.

The Eel Hole Creek Diversion, located in the south west corner of the mining lease, is about 70 m wide and 12m deep, with batter slopes of 3H:1V. The diversion covers an area of ~33.3 hectares. The creek banks are rehabilitated with self-sustaining grasses and shrubs.

The MRD, located partly within the western boundary of the mining lease, is ~7,000m long (within the ML), 125 m wide and 25 m deep, with an area of ~88.4 hectares. The riverbanks are rehabilitated with self-sustaining grasses and shrubs. The Morwell Main Drain (MMD) is located on the east field northern batters adjacent to Morwell and the M1 freeway. The MMD drains the southern parts of the Morwell township and the industrial area south of the Princess Freeway, and to the east of the mine. The MMD is a buried pipe and overflow channel and discharges into the Morwell River to the north of the mine (RGS, 2024)[1]. Stormwater ingress from this pipe contributed the development of sinkholes and the subsequence movement of the northern batters. The occurrence of this risk has driven the proposal to decommission the MMD and divert stormwater into the mine void.

HAZELWOOD COOLING POND

To the southeast of MIN5004, and off-lease, is the Hazelwood Cooling Pond (HCP) which covers approximately 5 km^2 and has a capacity of 17 GL. Its primary function was to cool water for recirculation back to the power station but was also used for recreational purposes. The HCP was created in 1961 through the construction of the Eel Hole Creek and south embankments and has a spillway which discharges to Eel Hole Creek. The pond receives discharge from Eel Hole Creek and its catchment area.

Overflow from the HCP discharges via the discharge point into the Eel Hole Creek (in accordance with EPA Licence No.46436).

WORKS EFFLUENT POND

The works effluent pond is located near the southern boundary of the MIN5004 area and will continue to collect surface water from the Hazelwood site and sections of the Eastern Overburden Dump (EOD). It will continue to operate as a surface water settlement pond for the future landform following rehabilitation.

1 RGS, Hazelwood EES: Lake water balance and water quality August 2024

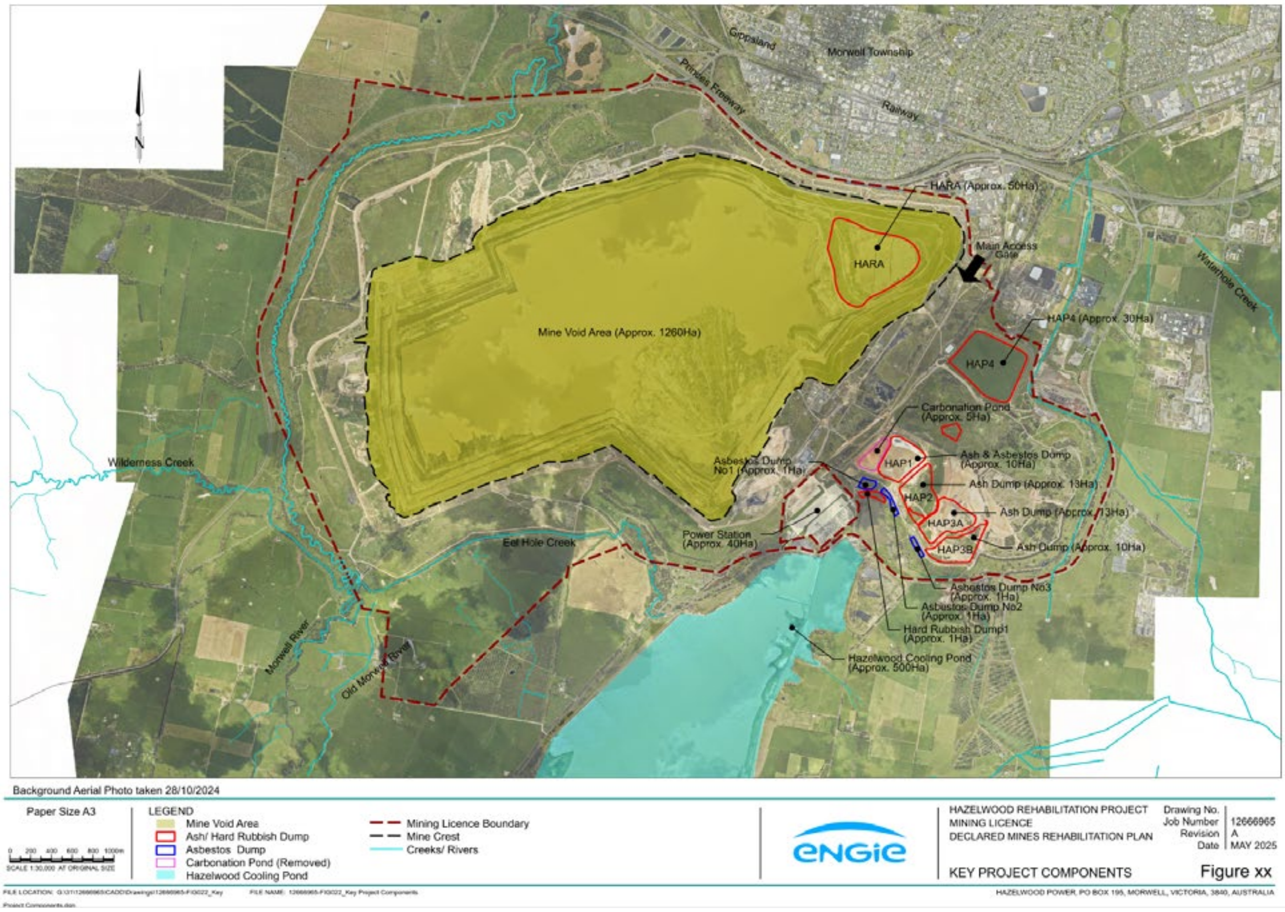

Figure 11.8: Hazelwood Mine site layout and major project features

8.3 GROUNDWATER

The Latrobe Valley occurs at the western end of the onshore part of the Gippsland Basin. Three main lignite bearing sequences occur in the Latrobe Valley, and are the Traralgon, Morwell and Yallourn Formations. Marine limestones and marls have accumulated and now cover much of the near-coastal onshore area of the Gippsland Basin.

Non-coal material between lignite seams is termed interseam and is comprised of sand, silt and clay. The interseam lithology can change rapidly due to the mode of deposition and can contain local and regional scale aquifers depending on the extent and hydraulic properties of the sand units. Some aquifers extend over large areas, and, partly through complex structures, into the offshore part of the Gippsland Basin. Other aquifers are only of local extent.

Two major Tertiary age aquifer systems occur in the Latrobe Valley separated by less permeable zones (aquitards) consisting of coal, clay and silt. These systems are interbedded with coal, clay, silt and weathered basalt units of variable thickness. A group of generally unconfined to semi-confined aquifers of Pliocene to recent age can be considered as representing a third, shallow regional aquifer system.

The qualifying word “system” is used to describe the aquifer sequence, as rarely does one aquifer exist on its own; rather, numerous sand, gravel and basalt aquifers of varying thickness, lateral extent and interconnection occur. Furthermore, within individual sand beds, there is a high degree of heterogeneity and anisotropy.

For the purpose of the DMRP, three regional aquifer systems are defined. These aquifers represent the Shallow, Morwell Formation and Traralgon Formation Aquifer Systems in the western part of the Gippsland Basin. Figure 11.9 shows a schematic hydrogeological cross section from the Yallourn East Field Mine through Hazelwood Mine and eastward to the Loy Yang Mine defining the major aquifers within the Latrobe Valley Mining area.

The regional hydrogeology of the Latrobe Valley consists of three major aquifer systems. Within these aquifer systems there are interbedded sequences of sand, gravel and basalt aquifers. The systems are rarely continuous throughout the region and vary in thickness, lateral extent and interconnectivity. With recognition of these complexities, the following three aquifer systems have been characterised within the Latrobe Valley and form the basis of the Hazelwood Mine conceptual hydrogeological model (GHD, 2018a).

8.4 SHALLOW AQUIFER SYSTEM (SAS)

The shallow aquifer system (SAS) consists of unconfined and semi-confined aquifers within the upper part of the stratigraphic sequence and is typically located close to the landscape surface. The water table typically resides in this system, including the Haunted Hills and alluvial sands aquifers encountered in the Hazelwood Formation. The SAS provides water supply for domestic and agricultural purposes and is typically low yielding. The Haunted Hills Formation (HHF) represents the main aquifer of the SAS in the Hazelwood Mine area. This formation is typically 9 m to 16 m thick at the Hazelwood Mine.

The HHF aquifer is an unconfined, highly heterogeneous aquifer comprising channel sand, clay levee and overbank deposits and contains the water table for most of the project area. The main source of recharge to the HHF is direct infiltration of rainfall, with elevated water levels beneath the Hazelwood Cooling Pond (HCP). However, the aquifer is absent in the mine void, leading to local groundwater flow toward it (ERM, 2024).

8.5 MORWELL FORMATION AQUIFER SYSTEM (MFAS)

The Morwell Formation Aquifer System (MFAS) comprises confined aquifers within the interbedded sand lenses of the Morwell interseams and referred to as the M1, M1A, M1B, M2A, M2B and M2C aquifers. The aquifers are separated by clay, coal seams and minor fractured basalt. The MFAS within the Hazelwood Mine area consists predominantly of sand lenses within the M1A interseam (referred to as the M1 aquifer) and is located between 100 m and 500 m below ground level. The M1 seam ranges in thickness from 50 m in the south to 135 m in the north. The bulk hydraulic conductivity of the M1 seam is interpreted to be several orders of magnitude lower than that of the adjoining Haunted Hills Formations, with groundwater flowing via cleats and fractures within the seam.

8.6 M2 / TRARALGON FORMATION AQUIFER SYSTEM (M2 / TFAS)

The M2 / Traralgon Formation Aquifer System (M2 / TFAS) contains confined aquifers consisting of interbedded sand, clay, coal and basalt (M2 and Traralgon aquifers) and is present across the Gippsland Basin. The M2 / TFAS aquifers generally occur between 150 and 1500 m below ground level. The M2 aquifer represents the main aquifer of the M2 / TFAS at the Hazelwood Mine and has a total thickness of 120 m to 200 m.

The general hydro stratigraphical units (HSUs) that comprise elements of the three major aquifer systems and the hydrogeological cross sections of Hazelwood Mine are presented in Figure 11.9 and Figure 11.10. The two key aquifers at the Hazelwood Mine requiring active management activities are the M1 and M2 aquifers. These aquifers are separated by the thick M1 and M2 coal seams acting as confining aquitards.

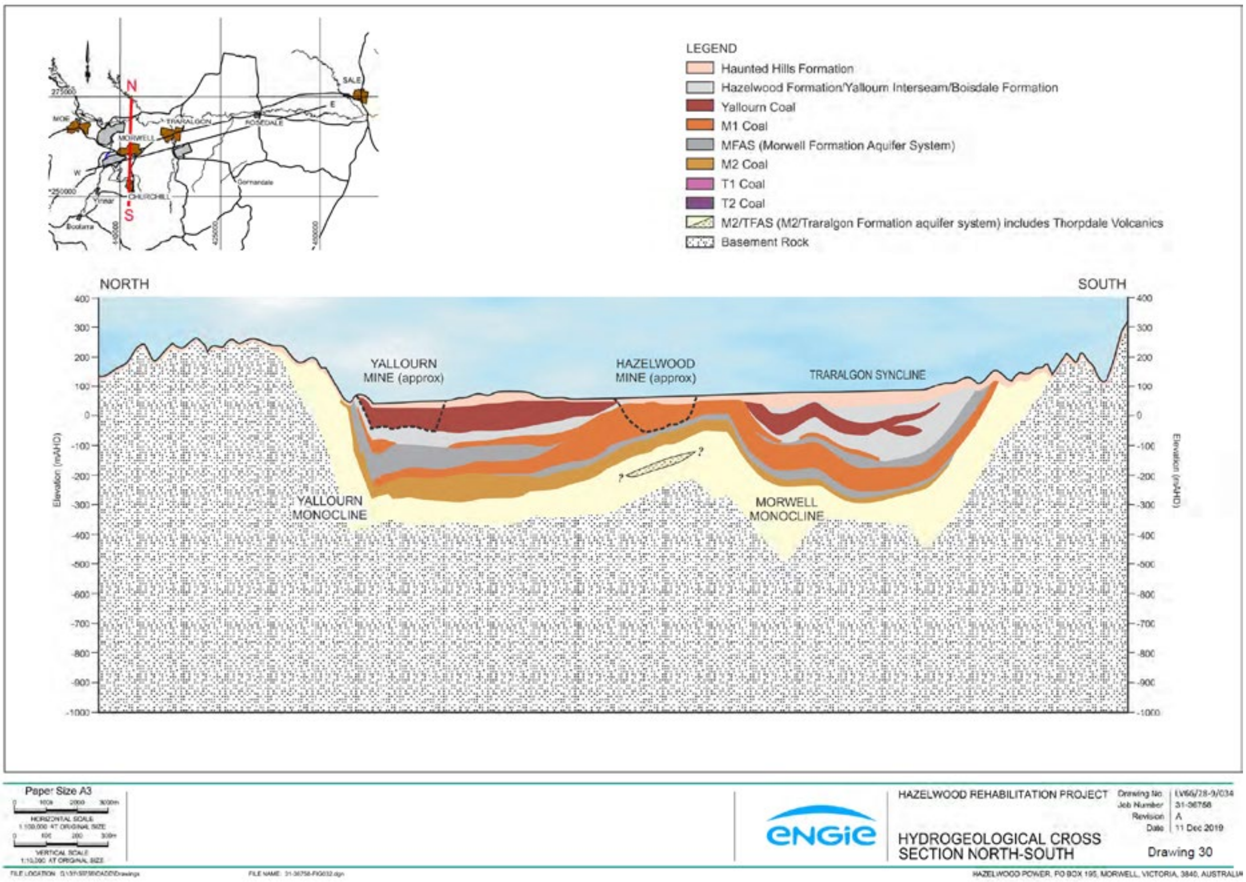

Figure 11.9: Hydrogeological cross section (north – south)

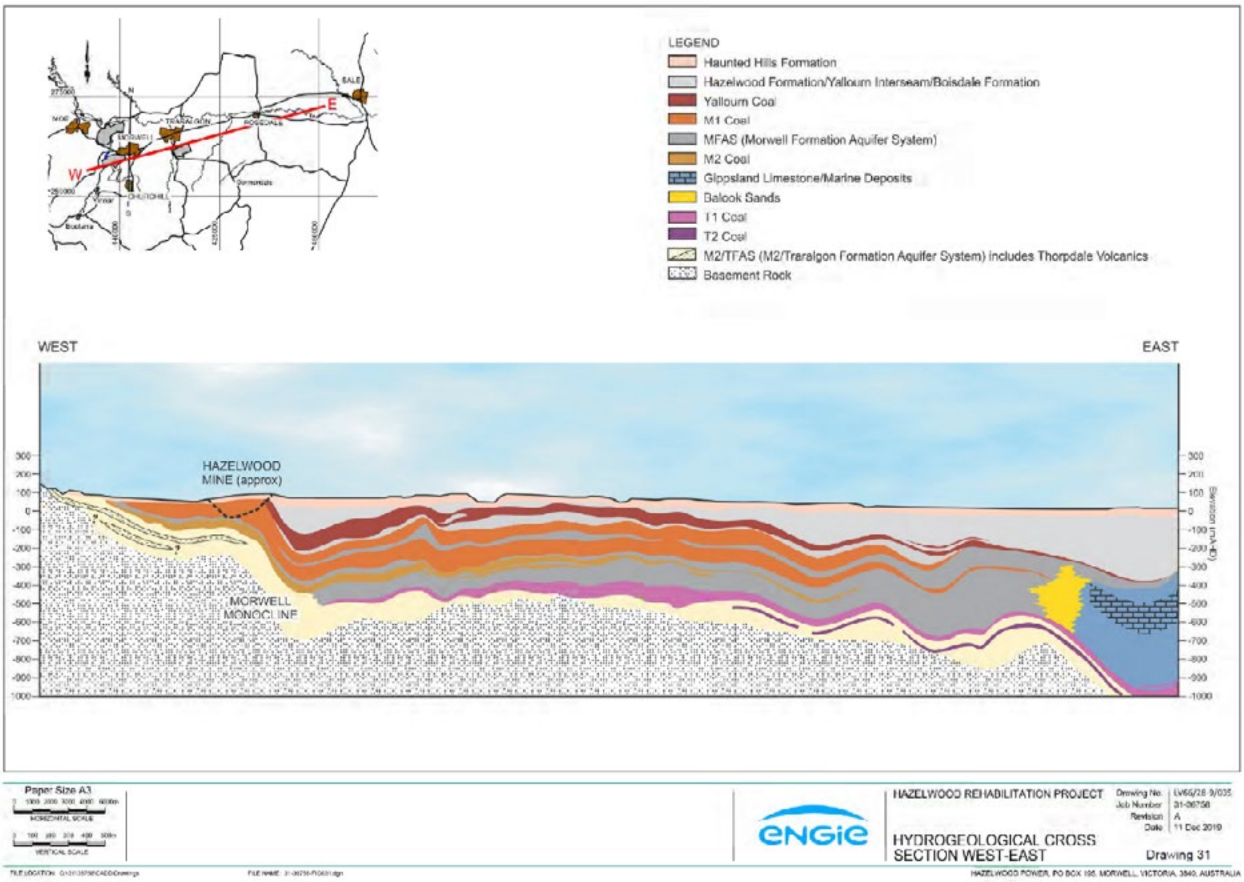

Figure 11.10: Hydrogeological cross section (west – east)

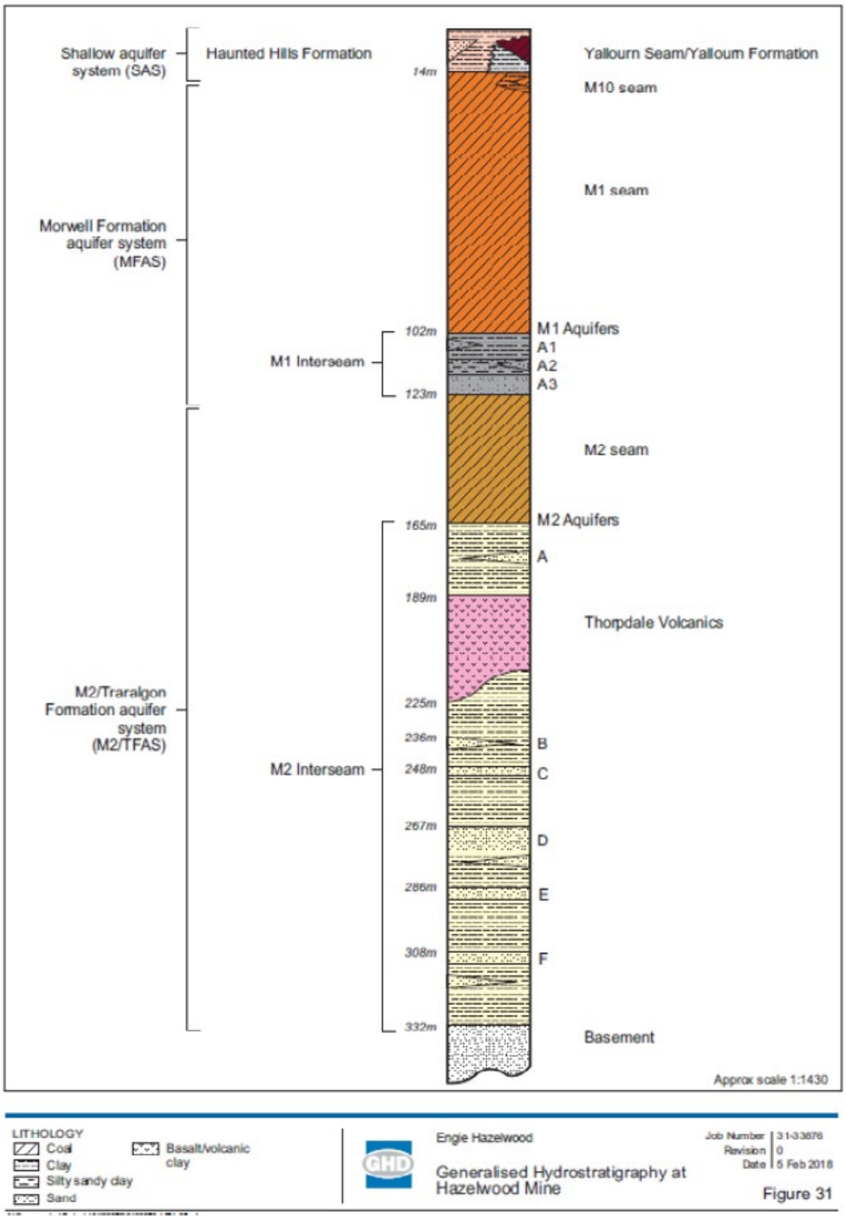

Figure 11.11: Generalised Hydrostratigraphy at Hazelwood Mine (GHD 2018a)

8.7 GROUNDWATER QUALITY

Groundwater quality characteristics of the M1 aquifer were initially described by Brumley et al (1981) as having a total dissolved solids (TDS) range between 311 mg / L to 890 mg / L and a slightly acidic pH ranging from 6 to 7. Chloride and bicarbonate formed the dominant anions, whilst sodium was found to be the dominant cation.

M1 aquifer pump bore groundwater quality data for the period 2016 to 2018 is summarised as follows (GHD, 2018g):
groundwater pH generally ranges between 5.5 and 6.5 and no consistent pH trends are evident;

- TDS concentrations typically under 400 mg / L (excluding anomalous bores);
- variable sulphate concentrations generally higher than 4 mg / L;
- low bicarbonate concentrations in the range of 45 to 65 mg / L (excluding one bore); and
- high iron concentrations typically between 1 to 5 mg / L with a median value of 2.4 mg / L.

Groundwater quality of the M2 aquifer shows similar pH, dominant cations and anions to the quality characteristics of the M1 aquifer, but is less saline with TDS values in the range of 311 mg / L to 686 mg / L.

M2 aquifer pump bore groundwater quality data for the period 2016 to 2018 is summarised as follows (GHD, 2018g):

- groundwater pH is typically in the 6.5 to 7.5 range and is relatively steady to 2015 after which show minor declining trend;
- higher TDS concentrations are typically in the 350 to 550 mg / L range,
- low sulphate concentrations, generally less than 5 mg / L;
- higher bicarbonate concentrations in the range of 130 to 190 mg / L; and
- low iron concentrations (<0.01 to 1.2 mg / L) with a median value of 0.3 mg / L.

The field temperature plots show a gradual decline in both M1 and M2 aquifer temperatures consistent with previous trends noted in pumping bores from Hazelwood and other mines.

M1 aquifer temperature typically range from 25˚C to 35˚C with the M2 bores generally hotter in the 40˚C to 50˚C range, as would be expected with the deeper M2 aquifer.

Some areas of the HHF have experienced groundwater contamination due to historical operations, particularly near the Hazelwood Power Block and the Eastern Overburden Dump (EOD). Groundwater quality near the HCP remains less understood but will be evaluated as part of ongoing environmental audits. No widespread contamination plumes have been identified in the HHF near the mine void. As groundwater levels and flow directions near the Hazelwood Power Block and EOD are not expected to change under baseline conditions, the groundwater quality and contamination distribution in the HHF are predicted to remain stable.

Discharge from the HHF is expected to occur locally in low elevation areas, with groundwater providing base flow to major streams and creeks.

Background total dissolved solids (TDS) levels in the HHF near Hazelwood range from 1,201mg/L to 3,100mg/L, aligning with Segment B of the ERS. A subsequent review in 2021 found TDS levels of 1,600mg/L in the west and 3,100mg/L in the east of the HHF, reinforcing this classification. The relevant environmental values of HHF groundwater include:

- Water-dependent ecosystems and species
- Potable mineral water supply (not applicable as the mine is not in a recognised area)
- Agricultural and irrigation uses
- Industrial and commercial applications
- Water-based recreation
- Traditional Owner cultural values
- Structural integrity for buildings (where groundwater is shallow)
- Geothermal properties (not applicable as groundwater temperatures are below 30ºC).

9. Ecology & Threatened communities

Threatened ecological communities (TECs) refer to naturally formed communities comprising plants, animals, and various organisms that occupy and interact in a unique habitat. TECs are categorized as vulnerable, endangered, or critically endangered based on the remaining population, threats leading to their decline, and the risk of extinction. To prevent further decline and facilitate recovery, TECs are officially recognized and protected under Commonwealth legislation, aiming to secure the long-term survival of the community.

Two EPBC Act-listed TECs are identified to potentially occur within the study area, based on published literature:

- Seasonal herbaceous wetlands (Freshwater) of the temperate lowland plains (seasonal herbaceous wetlands); and
- Gippsland red gum (*Eucalyptus tereticornis* subsp. *mediana*) grassy woodland and associated native grassland.

Table 11.1 EPBC Act listed threatened ecological communities (TEC)

TEC	DESCRIPTION
Seasonal herbaceous wetlands (freshwater) of the temperate lowland plains	The seasonal herbaceous wetlands (freshwater) of the temperate lowland plains (hereafter referred to as seasonal herbaceous wetlands) are listed as a critically endangered TEC. The community includes temporary freshwater wetlands that undergo seasonal inundation, typically filling up after winter-spring precipitation and subsequently drying out. These wetlands are predominantly treeless and are characterized by an herbaceous ground layer, often exhibiting a substantial presence of graminoids alongside forbs. The herbaceous species found in seasonal herbaceous wetlands are indicative of moist environments that retain water for extended periods and are typically absent or infrequent in adjacent dryland grasslands and woodlands. The composition of dominant plant species is contingent upon seasonal variations and specific site conditions, resulting in a variable range of floral diversity from relatively low to high species richness. A review of MapshareVIC indicates the presence of a pre-European wetland in the north of the site which is probably associated with the landforms of the Morwell River prior to modification.
Gippsland red gum (Eucalyptus tereticornis subsp. mediana) grassy woodland and associated native grassland	The Gippsland red gum Eucalyptus tereticornis subsp. mediana grassy woodland and associated native grassland community is listed as a critically endangered TEC. The community occurs in two forms; a grassy woodland form that is dominated by a tree canopy of Gippsland red gum with a graminoid-rich ground layer, and a grassland form where tree canopy cover is largely absent. Several other canopy tree species (Eucalypt spp), and tree species including Drooping Sheoak Allocasuarina erticillata and Black Sheoak Allocasuarina littoralis may occur alongside Gippsland red gum as part of the community. The ground layer and grassland form of the community is dominated by a suite of native graminoids including perennial tussock grasses (e.g. kangaroo grass), sedges, non-tufted grasses and other graminoids. A variety of herbs and wildflowers are also present in inter-tussock spaces. EVCs synonymous with the listed community include EVC 55 (plains grassy woodland) and EVC 132_61 (LaTrobe Valley plains grassland), both of which recognise the grassy woodland and anthropogenic grassland components of the nationally listed ecological community. Occurrences of Gippsland red gum at Hazelwood are recorded as planted. Areas of plains grassland and plains grassy woodland (EVCs synonymous with the TEC) have been assessed. Based on a review of the community description, key diagnostic characteristics, and condition thresholds, the treed form of the community does not occur within the study area. The derived grassland form of the community may occur within the ridge grassland where patches of EVC 132_61 (LaTrobe Valley plains grassland) was mapped.

9.1 EPBC ACT LISTED FLORA SPECIES

Flora species listed under the EPBC Act with a medium or greater likelihood of occurrence and potential habitat within the study area are listed in Table 2.1 and are discussed below in relation to their potential occurrence within the proposed works area.

Table 11.2: EPBC Act listed flora species known or with medium high likelihood of occurrence

COMMON NAME	SCIENTIFIC NAME	LIKELIHOOD OF OCCURRENCE	
		STUDY AREA	PROPOSED WORKS AREA
River Swamp Wallaby-grass	*Amphibromus fluitans*	Medium	Unlikely
Matted Flax-lily	*Dianella amoena*	Known	Unlikely (except priority conservation area excluded through a No Go Zone)
Strzelecki Gum	*Eucalyptus strzeleckii*	Known	Known

9.2 EPBC ACT LISTED FAUNA SPECIES

Fauna species listed under the EPBC Act with potential to occur in the study area are those with a likelihood of occurrence rating of medium or greater and are listed in Table 6.4. The list is based on ratings assigned during the desktop and habitat assessments. For some species the likelihood of occurrence was revised following targeted survey.

Table 11.3: EPBC Act listed fauna species known or with medium high likelihood of occurrence

COMMON NAME	SCIENTIFIC NAME	LIKELIHOOD OF OCCURRENCE	
		STUDY AREA	PROPOSED WORKS AREA
Australasian Bittern	*Botaurus poiciloptilus*	Known	Known
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Known	Medium (presence assumed)
White-throated Needle-tail	*Hirundapus caudacutus*	Known	Known
Growling Grass Frog	*Litoria raniformis*	Unlikely (revised from medium after targeted survey)	Unlikely (revised from medium after targeted survey)
Dwarf Galaxias	*Galaxiella pusilla*	Low (revised from medium after targeted survey)	Low (revised from medium after targeted survey)
Australian Grayling	*Prototroctes maraena*	High (presence assumed)	Unlikely*

**potential to occur in Morwell River*

9.3 STATE SIGNIFICANT BIODIVERSITY VALUES

NATIVE VEGETATION

The Hazelwood site has been subject to permitted extensive clearance and modification due to historical agricultural and coal mining activities. Patches of native woodland vegetation persist in net gain offset sites (Eel Hole Creek/Hazelwood Cemetery, and Old Strzelecki Highway), areas of former roadsides west of the mine void (old Strzelecki Highway, Deans Road and Golden Gully Road), the original Morwell River alignment south of the mine void and the Ridge Grasslands east of the mine void.

A patch of swamp scrub persists to the north-west of the mine void. Scattered trees (not in patches) occur west of the mine void and in agricultural leased land to the south of the mine. Tall Marsh has established in the water storage ponds and on the margins of the Morwell River and Eel Hole Creek Diversions.

ECOLOGICAL VEGETATION CLASSES

Native vegetation is generally represented by three broad ecological communities: grasslands, wooded vegetation and areas associated with aquatic environments including swamps, marshes and riparian vegetation. Further delineation of EVC type was undertaken in accordance with the Guidelines (DELWP, 2017). Extensive historical landscape disturbance has altered key characteristics that are used to differentiate EVC type within the study area, the presence of overstory strata (derived grasslands) and modified canopy species diversity are essentially no longer present or too modified for diagnostic use. In the absence of the distinguishing characteristics that allow for EVC delineation the occurrence of EVCs in some instances was guided by DEECA modelled vegetation extent.

Six EVCs have been recorded in within and in close proximity to Hazelwood. These EVCs and their bioregional conservation status within the Gippsland Plain Bioregion are listed in Table 11.4 below.

Table 11.4: Ecological Vegetation Classes recorded within the project area and their bioregional conservation status

EVC NUMBER	EVC NAME	BIOREGIONAL CONSERVATION STATUS (GIPPSLAND PLAIN BIOREGION)	DESCRIPTION
53	Swamp Scrub	Endangered	The benchmark description of Swamp Scrub (EVC 52) is that it is typically a “closed scrub to 8 m tall at low elevations on alluvial deposits along streams or on poorly drained sites with higher nutrient availability. The EVC is dominated by Swamp Paperbark *Melaleuca ericifolia* (or sometimes Woolly Tea-tree *Leptospermum lanigerum*) which often forms a dense thicket, out-competing other species. Occasional emergent eucalypts may be present. Where light penetrates to ground level, a moss/lichen/liverwort or herbaceous ground cover is often present. Dry variants have a grassy/herbaceous ground layer.” (DSE, 2004) Patches of swamp scrub within the study area are generally modified and likely represent fragments of an EVC associated with seasonally inundated areas. The canopy is generally dominated by dense thicket of Swamp Paperbark *Melaleuca ericifolia*. Emergent understory tree species are occasionally present and include Blackwood *Acacia melanoxylon*. The understorey strata are generally dominated by grassy and herbaceous species including Spiny-head mat-rush, Tussock-grass and occasionally Kangaroo grass.
55	Plains Grassy Woodland	Endangered	The benchmark description of Plains Grassy Woodland (EVC 55) is “an open, eucalypt woodland to 15 m tall occurring on a number of geologies and soil types. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer.” (DSE, 2004) Plains Grassy Woodland is represented across the study area by patches of varying size and quality. Generally dominated by Manna Gum *Eucalyptus viminalis* the midstorey strata are dominated by Blackwood *Acacia melanoxylon* and Golden Wattle *Acacia pycnantha*. Ground level strata are generally dominated by Spiny-head mat-rush *Lomandra longifolia*, Bracken Fern and Kangaroo Grass. Common weeds in patches of Plains Grassy Woodland include (but are not limited to) Kikuyu grass and Bulbous Canary Grass. Patches of Plains Grassy Woodland in the ‘Ridge Grassland’, located south from the entry gatehouse represent patches of the highest quality of this EVC within the study area. Floristic strata in these patches somewhat resemble the description and lifeform covers included in the benchmark description of the EVC. It should be noted that understorey species in this area includes representatives from Orchidaceae, and a diverse suite of midstorey shrubs.
83	Swampy Riparian Woodland	Endangered	Swampy Riparian Woodland typically consists of a “*woodland to 15 m tall generally occupying low energy streams of the foothills and plains. The lower strata are variously locally dominated by a range of large and medium shrub species on the stream levees in combination with large tussock grasses and sedges in the ground layer*.” (DSE, 2004) Dominant canopy species in patches of Swampy Riparian Woodland within the study area include Strzelecki Gum. Some specimens of Strzelecki Gum within the study area are likely planted however, in the context of the project the species is considered within its distribution range (VicFlora, 2024) where it favours ridges, slopes and stream embankments on deep fertile soils. Occurrences of Strzelecki Gum as planted specimens are considered native vegetation as the intent of planting includes revegetation for conservation and biodiversity purposes. A midstorey suite of dominant small to medium shrubs and understory trees are present including Blackwood, *Acacia melanoxylon*, Silver Wattle *Acacia dealbata*, Black Wattle *Acacia meransii* and Swamp Paperbark. Ground layer lifeforms are notably absent from most patches of Swampy Riparian Woodland within the study area and a high cover of exotic grass generally occupying the ground layer.
132_61	Plains Grassland (La Trobe Valley)	Endangered	The benchmark description for Plains Grassland (LaTrobe Valley) describes a “*treeless vegetation dominated by largely grass and herb life forms. Shrubs and trees may be also occasionally present*.” (DSE, 2004). Pre 1750s EVC mapping from the study area does not include any purely grassland EVCs. Rather, historic EVC mapping includes several grassy woodland or forest EVCs. Patches of native grassland vegetation within the study area likely represent a derived grassland likely as a result of historic clearing. Given the change in vegetation structure the ‘best fit’ for patches of native vegetation is EVC Plains Grassland (LaTrobe Valley) (EVC 132_61). Patches of Plains Grassland (LaTrobe Valley) are dominated by a high cover of Kangaroo Grass and Thatch saw-sedge *Gahnia radula*. A suite of herbaceous and medium tufted graminoid lifeforms are present in the understorey strata layers including but not limited to *Dianella* spp., Yellow Rush-Lily *Tricoryne elatior*, Running Postman *Kennedia prostrata* and Common Riceflower *Pimelea humilis*. Some areas of Burgan *Kunzea* spp. are present as a medium (1-5m) and small shrub (0.2-1m), the occurrence of this species is within the description of this EVC however is likely on the threshold of ‘occasionally present’ in some areas. The occurrence of Burgan indicates the recolonisation and early successional state of a woodland or forest EVC; however, continued management has prevented establishment of trees and has favoured the persistence of grassland flora.
151	Plains Grassy Forest	Vulnerable	Plains Grassy Forest EVC is typically an “open forest to 20 m tall often above a heathy shrub layer and a diverse grassy, sedgy and herbaceous ground layer. Occurs on lowland plains and old river terraces made up of gravelly sandy clays.” (DSE, 2004). Patches of Plains Grassy Forest are dominated in the canopy strata by But But *Eucalyptus bridgesian*a and Manna Gum *Eucalyptus viminalis*. Midstorey species dominated by a suite of Acacia spp. and ground layer understorey species dominated by Spiny-headed Mat-rush *Lomandra longifolia*, Kangaroo grass, Bracken fern *Pteridium esculentum*, and Burgan. Orchid species are also present.
821	Tall Marsh	Depleted	The benchmark description for Tall Marsh is a “closed to open grassland/sedgeland to 3 m tall, dominated by Common Reed and Cumbungi. Small aquatic and semi-aquatic species occur amongst the reeds. Occurs on Quaternary sedimentary geology of mainly estuarine sands, soils are peaty, silty clays, and average annual rainfall is approximately 600 mm. It requires shallow water (to 1 m deep) and low current-scour and can only tolerate very low levels of salinity.” (DSE, 2004) The Tall Marsh EVC provides the ‘best fit’ for patches of native vegetation dominated by Common Reed and / or Broadleaf Cumbungi *Typha orientalis* within the study area. Species common to patches of Tall Marsh within the study area include Water Ribbons *Triglochin procera* and *Eleocharis* spp. Areas of tall marsh likely represent areas of historically modified native vegetation that once may have supported similar riparian or swampy EVCs.

9.4 THREATENED FLORA SPECIES

Threatened flora species are those which are listed as threatened under the FFG Act. Some species listed under the FFG Act area also listed as threatened under the EPBC Act and discussed above in Section 5.12.3. Several flora species listed as threatened under the FFG Act have been identified on site through previous studies.

Six species listed as threatened under the FFG Act are known to occur or are considered to have medium to high likelihood of occurrence. Table 11.6 lists the FFG Act listed flora species with potential to occur in the study area and assesses whether the species could occur in the proposed works area.

Table 11.6: FFG Act listed flora species known or with medium or high likelihood of occurrence[2]

COMMON NAME	SCIENTIFIC NAME	FFG ACT STATUS	OCCURRENCE	DESCRIPTION
Sticky wattle	*Acacia howittii*	Vulnerable	Medium likelihood of occurrence in moist forest, lowland and foothill environments. Species recently recorded in within 5km of the study area and the study area contains habitat that may be suitable for the species.	Sticky wattle distribution is confined to eastern Victoria and its range extends from the upper Macalister River area near Mt Howitt south to near Yarram and east to near Tabberabbera (VicFlora, 2024). Habitat for Sticky Wattle typically consists of moist forests and woodlands where it grows on a wide range of soil types. A single individual was recorded during flora surveys for the Hazelwood Mine West Field Project (Biosis Research, 2003).
Common apple-berry	*Billardiera scandens s.s.*	Endangered	Medium likelihood of occurrence in dry open-forests and woodlands. Species has been recently recorded within 5km of the study area and the study area contains habitat that may be suitable for the species.	Common apple-berry (also known as Velvet Apple-berry) occurs in open forests, woodlands, heathlands generally in the north, but also coastal areas. It thrives in well-drained soils and is often seen climbing over rocks, shrubs, or other vegetation (VicFlora, 2024). A single individual was recorded during flora surveys for the Hazelwood Mine west field project.
Grey Billy-buttons	*Craspedia canens*	Critical	Medium likelihood of occurrence. The study area is within the species' natural distribution. Species known from nearby (Traralgon) and suitable habitat is present within the study area (areas of remnant vegetation).	There is one record of Grey Billy-buttons within 5km of the study area. The most recent record is from 2004 (DEECA 2024).
Green scentbark	*Eucalyptus fulgens*	Endangered	Known to occur. Recorded during VQA assessment and as part of previous ecological assessments. Habitat limited to areas of remnant vegetation.	There are 14 records within 5km of the study area the most recent record was 2008 (DEECA 2024). Recent survey results from the Hazelwood site suggest occurrence is likely to occur as a result of revegetation efforts. Green Scentbark occurs from Healesville to Woori Yallock to the LaTobe Valley near Driffield. It is typically associated with Gully Woodland Herb-rich Foothill Forest and Swampy Woodland vegetation types on moist loam soils.
Yarra gum	*Eucalyptus yarraensis*	Critical	Known to occur. Identified during VQA assessment.	Yarra gum was recorded during the current vegetation quality assessment and there are 15 records within 5km of the study area. The most recent record is from 2021. Several records of the species are located in close proximity to the site, including within the Eric Lubcke Yarra Gum Reserve located less than 100 metres from the northern edge of the mine boundary. There are also records along surrounding roadsides near the HCP. The species has also been used in revegetation plantings along Bennetts Creek riparian corridor.

2 Table generated from EES Technical Report H:Ecology, AECOM, 2025

9.5 THREATENED FAUNA SPECIES

Fauna species listed under the FFG Act that were assigned a medium or higher likelihood of occurrence in the site are listed in Table 11.7. Those species are:

- Aquatic mammal: platypus
- Birds of prey: grey goshawk, white-bellied sea-eagle, little eagle
- Ducks: blue-billed duck, musk duck, Australasian shoveler
- Birds: Lewin's rail
- Egrets and herons: eastern great egret, little egret, Australian little bittern
- Reptiles: swamp skink, glossy grass skink
- Fish: Flinders pygmy perch

A description of the FFG Act listed species known or most likely to occur in the study area is provided below along with an indication of areas of habitat within the proposed works area.

Table 11.7: FFG Act listed fauna species known or with medium or high likelihood of occurrence[3]

COMMON NAME	SCIENTIFIC NAME	FFG ACT STATUS	LIKELIHOOD OF OCCURRENCE	DESCRIPTION
MAMMALS				
Platypus	*Ornithorhynchus anatinus*	Vulnerable	Known	The platypus, listed as vulnerable under the FFG Act, is a small, egg-laying mammal native to eastern Australia and Tasmania. This semi-aquatic species feeds on small invertebrates in water and rests in burrows near the water's edge, where they also lay and incubate their eggs. Burrow entrances are typically hidden in undercut banks with overhanging vegetation or underwater. A positive relationship exists between the presence of shrubs and trees on waterway banks and burrow locations. eDNA detected platypus presence along the Morwell River upstream of the mine and in the Morwell River Diversion, though not at the Princes Freeway bridge downstream. The species likely uses the Morwell River Diversion for movement and foraging, but the presence of burrows in this area is unknown.
WOODLAND BIRDS				
Grey goshawk	*Accipiter novaehollandiae*	Endangered	Medium	Grey goshawks inhabit various forests and woodlands, especially tall, closed forests, including rainforests, tall woodlands and timbered watercourses; disperse to more open country in autumn-winter. Potentially suitable habitat is present in remnant and planted forest and woodland within the study area. Species may occasionally use the habitat for foraging and roosting but is unlikely to depend on the area. Potential habitat in the proposed works area comprises the original Morwell River south of the mine void and planted vegetation along the Morwell River Diversion.
White-bellied sea-eagle	*Haliaeetus leucogaster*	Endangered	Known	White-bellied sea-eagles hunt primarily for fish over large areas of open water and along waterways. The species is sensitive to human habitation and disturbance and may therefore prefer areas away from the mine. Birds form pairs for life and are mostly sedentary once they establish a home range. Distribution of records suggest two population concentrations – around the Gippsland lakes and Corner Inlet, with other pairs scattered through the rest of Victoria. White-bellied sea-eagles are known to occur in the study area. White-bellied sea-eagles have been observed on the HCP and EOD during avifauna surveys. White-bellied sea-eagles are likely to hunt over the Hazelwood site but do not appear to be nesting on site.
Little eagle	*Hieraaetus morphnoides*	Vulnerable	High	The little eagle is listed as vulnerable under the FFG Act. There are two previous records on the VBA for this species within 5km of the study area with the most recent from 2001 (FFGSAC 2020). The little eagle is a bird of prey (raptor) mostly recorded from wooded farmlands and dry, open woodlands where the species preys heavily on rabbits as most of its former mammalian prey are extinct or in decline. Little eagles prefer more intact areas of woodland, rarely nest in isolated trees and tend to prefer tall mature trees. Species may occasionally use the area and proposed works area for hunting and roosting but unlikely to depend on the area.
AQUATIC BIRDS				
Eastern great egret	*Ardea alba modesta*	Vulnerable	Known	The Eastern great egret can occur in a range of habitats including minor creek lines, drains, around the margins of dams where there is shallow open water in which they can wade. The species is usually solitary when hunting and nests colonially with colonies known in the Riverina region of Victoria (Menkhorst et al. 2017; SPRAT). The Eastern great egret is likely to use aquatic habitats (dams, creeks, rivers, water storages) in the study area for foraging and roosting, but the species is unlikely to depend on, or breed in, the area. Suitable habitat in the proposed works area comprises water storages (southern outlet pond and WEP), Morwell River Diversion (inflow and outflow channels), and HCP.
Little egret	*Egretta garzetta nigripes*	Endangered	Medium	The little egret is usually found on tidal mudflats, and in brackish and saltwater wetlands, including saltmarshes, estuaries, and mangroves. Less often found in freshwater wetlands and occasionally observed in sewage ponds. The species nests colonially with other waterbirds and is nomadic depending on water levels in wetlands (Menkhorst et al. 2017). Species may use aquatic habitat present within study area or proposed works area for foraging on occasion but is unlikely to depend on those habitats as they are not primary habitat types for Little Egret.

3 Table generated from EES Technical Report H:Ecology, AECOM, 2025

COMMON NAME	SCIENTIFIC NAME	FFG ACT STATUS	LIKELIHOOD OF OCCURRENCE	DESCRIPTION
Australian little bittern	*Lxobrychus dubius*	Endangered	High	The Australian little bittern primarily inhabits dense emergent vegetation in freshwater wetlands, such as reedbeds, but can also be found in inundated shrub thickets and small wetlands. Unlike the Australasian Bittern, it often resides in small patches of dense wetland vegetation along drains or in urban lakes. This migratory species is present in south-eastern Australia during spring and summer and is very cryptic, often detected by its call. In the study area potential habitats include water storages like the Southern Outlet Ponds and WEP, as well as the HCP. The species may also use less optimal habitats such as the Morwell River and Eel Hole Creek Diversions where reed beds are present.
Lewin's rail	*Lewinia pectoralis*	Vulnerable	High	Lewin's rail is a cryptic species which favours areas of dense cover in coastal or near coastal wetlands (reeds, saltmarsh, tussocks) but can also occur in wetlands in rainforests, woodlands and heathlands. Forages for invertebrates in shallow water or exposed mud or leaf litter (Menkhorst et al. 2017). Species may use aquatic habitat with fringing vegetation present within study area and proposed works area for foraging, roosting, and breeding. Habitat suitable for Lewin's rail include sedge or reed dominated wetlands, dams and ponds and tracts of scrub that align with depressions and drainage lines.
Musk duck	*Biziura lobata*	Vulnerable	Medium	Musk ducks tend to be found in deep freshwater lagoons with patches of dense reed beds (Menkhorst et al. 2017). The species can inhabit more open waters in the non-breeding season and occasionally coastal areas and estuaries. Musk ducks may use aquatic habitat in study area and proposed works area (dams and water storages) on occasions but is unlikely to depend on the habitat. The HCP may be too large an expanse of water with too large a fetch to be suitable for this species when windy. Musk Duck has been recorded on the HCP previously and may therefore opportunistically use this habitat feature when conditions are suitable.
Blue-billed duck	*Oxyura australis*	Vulnerable	Known	The blue-billed duck, listed as vulnerable under the FFG Act, primarily inhabits deep freshwater swamps with dense vegetation. During the non-breeding season, they prefer large dams and lakes, while in the breeding season, they move to smaller wetlands with abundant vegetation. Their habitats are categorized into breeding, loafing, and drop-in habitats, each with specific characteristics. Breeding habitats are smaller with deep water and significant vegetation, while loafing habitats are larger water areas like sewage ponds. Drop-in habitats are used briefly, often during migration. The species breeds at various sites in Victoria, with notable concentrations in southern Victoria, especially in artificial wetlands like the Melbourne Water Western Treatment Plant. Seasonal conditions influence their movement between wetlands. The blue-billed duck may use the southern outlet ponds and WEP for foraging and resting, though large expanses of water may be less suitable during windy conditions
Australasian shoveler	*Spatula rhynchotis*	Vulnerable	Medium	The Australasian Shoveler inhabits various wetlands ranging from terrestrial swamps, and lakes to estuaries, coastal inlets and artificial waterbodies (e.g. dams, sewage ponds). Species prefers large, deep, well-vegetated freshwater swamps and wetlands with areas of open water fringed by abundant aquatic vegetation. Species may opportunistically use aquatic habitat present within study area and proposed works area. Breeds in swamps in inland Australia therefore unlikely to breed in the area. Australasian shovelers may occur in the southern outlet pond or WEP and HCP within the proposed works area. The Australasian shoveler has been recorded on the HCP previously and may therefore opportunistically use this habitat feature when conditions are suitable.
REPTILES				
Swamp skink	*Lissolepis coventryi*	Endangered	High	The swamp skink, listed as endangered under both the FFG Act and the EPBC Act, is considered for this assessment under the FFG Act. Potential habitats identified include riparian forests, reed areas along rivers and creeks, larger wetlands, and scrub vegetation. The northern study area is more likely to be suitable due to its connectivity and proximity to previous sightings. The species was recorded near the Morwell River bridge in 2007 and 2018. Potential habitats within the study area include swamp scrub north-west of the mine void, Morwell River Diversion, Eel Hole Creek Diversion, Eel Hole Creek conservation area, Wilderness Creek, and possibly Brodribb Road wetland. The swamp skink is assumed to be present in the area.
Glossy grass skink	*Pseudemoia rawlinsoni*	Endangered	High	The glossy grass skink is listed as endangered under the FFG Act and is being considered for listing as threatened under the EPBC Act. The glossy grass skink is patchily distributed across eastern and southern Victoria. The species occurs in densely vegetated, humid microhabitats typically near creeks, swamps, lakes and saltmarshes (Farquhar et al 2023). The glossy grass skink has been previously recorded in Morwell River wetlands north of Princes Freeway; recorded in 2008 through capture and release (VBA). There is another VBA record from 1992 from Churchill to the south-east of the study area. The species occurs in the Hazelwood area.
FISH				
Flinders pygmy perch	*Nannoperca spp.*	Vulnerable	Known	The Flinders pygmy perch, listed as vulnerable under the FFG Act, inhabits slow or still waters with abundant aquatic vegetation, such as lakes, ponds, and slow-moving creeks and rivers. It is found in various locations including Merriman's Creek, South Gippsland, and the La Trobe River catchment, with a small population in Pebble Creek. Surveys have detected the species in the Morwell River wetlands and other nearby areas. The species is assumed present in all connected waterways within the study area, except for disconnected sites like certain ponds and dams. Recent surveys recorded the Flinders pygmy perch in the Morwell River south of the mine void, though it was not found in some historically suitable habitats. The species is likely to occur in the Morwell River within the proposed works area and is known from wetlands downstream of this area.

9.6 WEEDS

Weeds are listed and categorised under the CaLP Act based on management requirements for those species. The Australian Government has also listed 32 species as Weeds of National Significance (WoNS) under the National Weeds Strategy 2017 -2027 (Invasive Plants and Animals Committee, 2017) as having high levels of invasiveness, potential for spread and negative social and economic impacts. CaLP Act listed weeds and WoNS observed in the study area during field assessments are listed in [Table 11.8].

Table 11.8: CaLP Act and WoNS observed in the study area

SCIENTIFIC NAME	COMMON NAME	WEST GIPPSLAND CMA CALP ACT STATUS	WONS STATUS
Agapanthus sp.	Agapanthus	Restricted weed	-
Asparagus asparagoides	Bridal creeper	Restricted weed	Y
Cirsium vulgare	Spear thistle	Regionally Controlled Weed	-
Crataegus monogyna	Hawthorn	Regionally Controlled Weed	-
Cynara cardunculus	Artichoke thistle	Regionally Prohibited Weeds	-
Genista monspessulana	Montpellier broom	Regionally Controlled Weed	-
Hypericum perforatum	Perforate St John's-wort	Regionally Controlled Weed	-
Juncus acutus	Spiny rush	Regionally Controlled Weed	-
Lycium ferocissimum	African boxthorn	Regionally Controlled Weed	-
Marrubium vulgare	Horehound	Regionally Controlled Weed	-
Rosa rubiginosa	Sweet briar	Regionally Controlled Weed	-
Rubus Fruticosus spp. agg	Blackberry	Regionally Controlled Weed	Y
Watsonia sp.	Bugle lily	Regionally Controlled Weed	-

9.7 PEST ANIMALS

Introduced predators such as foxes and feral cats directly threaten native fauna via predation. Other introduced species such as rabbits and hares can cause indirect impacts through land degradation and can have significant impacts on native vegetation and fauna habitat.

Pest animals previously recorded at Hazelwood include:

- Red Fox (CalP Act listed);
- Cat (CalP Act listed);
- European Rabbit (CalP Act listed);
- European Hare (CalP Act listed);
- Common Starling (not CaLP Act listed); and
- Common Myna (not CaLP Act listed).

9.8 PATHOGENS

Two pathogens are recognised as threatening processes under the EPBC Act and FFG Act:

CINNAMON FUNGUS

Cinnamon fungus *(Phytophthora cinnamomic)* is an introduced water mould that attacks the root systems of susceptible native plants including woody perennial plants from the Proteaceae (*Grevillea spp., Hakea spp*.), Fabaceae (peas), Dilleniaceae (*Hibbertia spp*.) and Epacridaceae (heath) families. Cinnamon fungus threatens the ecosystems which the susceptible plant species form part of and the animals that depend on them for habitat (DSE, 2008; DoEE, 2018). The current range of cinnamon fungus in Victoria is extensive but patchy in response to factors including temperature, rainfall and soil types. Environments considered most conducive to infection are those with temperate climates and rainfall that exceeds 600 mm per year. However, the public land management strategy nominates a more conservative 500mm isohyet to establish risk areas in Victoria in recognition that the pathogen may also thrive in areas subject to intermittent water logging. If climate change results in wetter summers and warmer winters, it may lead to a greater virulence of Cinnamon Fungus and potential extension of its range (DSE, 2008).

Cinnamon fungus is assumed to be present at Hazelwood given it is in the potential range for the pathogen as identified in DSE (2008).

CHYTRID FUNGUS

Chytrid fungus (*Batratchochytrium dendrobatidis)* causes chytridiomycosis in amphibians. Chytridiomycosis an infectious disease that has been found throughout the cool and wet areas of Australia. The fungus invades the surface layers of the frogs' skin disrupting the normal function of the skin leading to 100 per cent mortality in frog populations in eastern Australia populations and fewer deaths in other populations in western areas of Australia (DoEE, 2016). Chytrid Fungus appears to be confined to the relative cool and wet areas of Australia such as the Great Dividing Range and adjacent coastal areas. Only very few areas of suitable host environment remain uninfected.

Chytrid fungus is assumed (and likely) to be present at Hazelwood given it is within a suitable environment and the recognition that very few such areas remain uninfected.

MYRTLE RUST

Although not currently identified as a threatening process under the EPBC Act and FFG Act, another pathogen of concern due to its potential impact on native species is Myrtle rust (*Austropuccinia psidii*). Myrtle rust is a fungal pathogen that infects plants in the Myrtaceae family, including native Australian species like eucalypts, tea trees, and bottlebrushes. Myrtle rust can cause defoliation, stunted growth, and even mortality in susceptible plants, affecting ecosystems where these species play vital roles.

Myrtle rust was first detected in NSW but has since been recorded in Victoria in public parks and private residences in Shepparton, Ballarat, Shire of Cardinia and East Gippsland.

It is unknown whether myrtle rust is already present in the myrtaceous species in the study area. Given the pathogen has generally, at this stage, been detected in more public places it may not be present unless it has been inadvertently introduced during revegetation works. This pathogen poses a threat to plants in the Myrtaceae family including eucalypt species if present in the environment. Whilst the impacts of myrtle rust on Strzelecki gum have not been extensively studied this pathogen may affect this species.

9.9 GROUNDWATER DEPENDENT ECOSYSTEMS (GDE)

Potential GDEs with moderate to high potential include wetlands as identified by DEECA mapping or with unclassified potential to be GDEs that do not appear to be operational or anthropogenic features.

GDE analysis is initially built upon information contained in the GDE Atlas which is displayed in Table 11.12. The 2025 EES notes that terrestrial and aquatic GDEs, where present, are likely to be associated with the Haunted Hills Formation (HHF) unconfined aquifer and are not likely to be connected to the M1 and M2 aquifers, which are likely to be too deep and naturally confined (Technical Report E: Groundwater (ERM 2024).

ERM (2024) state regarding GDE Atlas that "…subterranean systems were not specifically analysed in this region, either inside or outside of the project area." The general conclusion in (ERM, 2024) is that the specific sediment characteristics are unlikely to support stygofauna and thus subterranean GDEs, even where suitable habitat may be present in "…unconsolidated Quaternary aquifer alluvium present in the Gippsland Basin" (ERM, 2024). As such no subterranean GDEs are considered present within the study area.

A summary of aquatic and terrestrial GDEs identified within the "…study area (within 2 km of the project area) with high or moderate potential to be reliant upon the surface expression of groundwater" (ERM 2024) is present in Table 11.12. A description of landform features is provided in the aforementioned table which further discuss the potential of occurrence of aquatic and terrestrial GDEs and reliance on groundwater of specific ecological features.

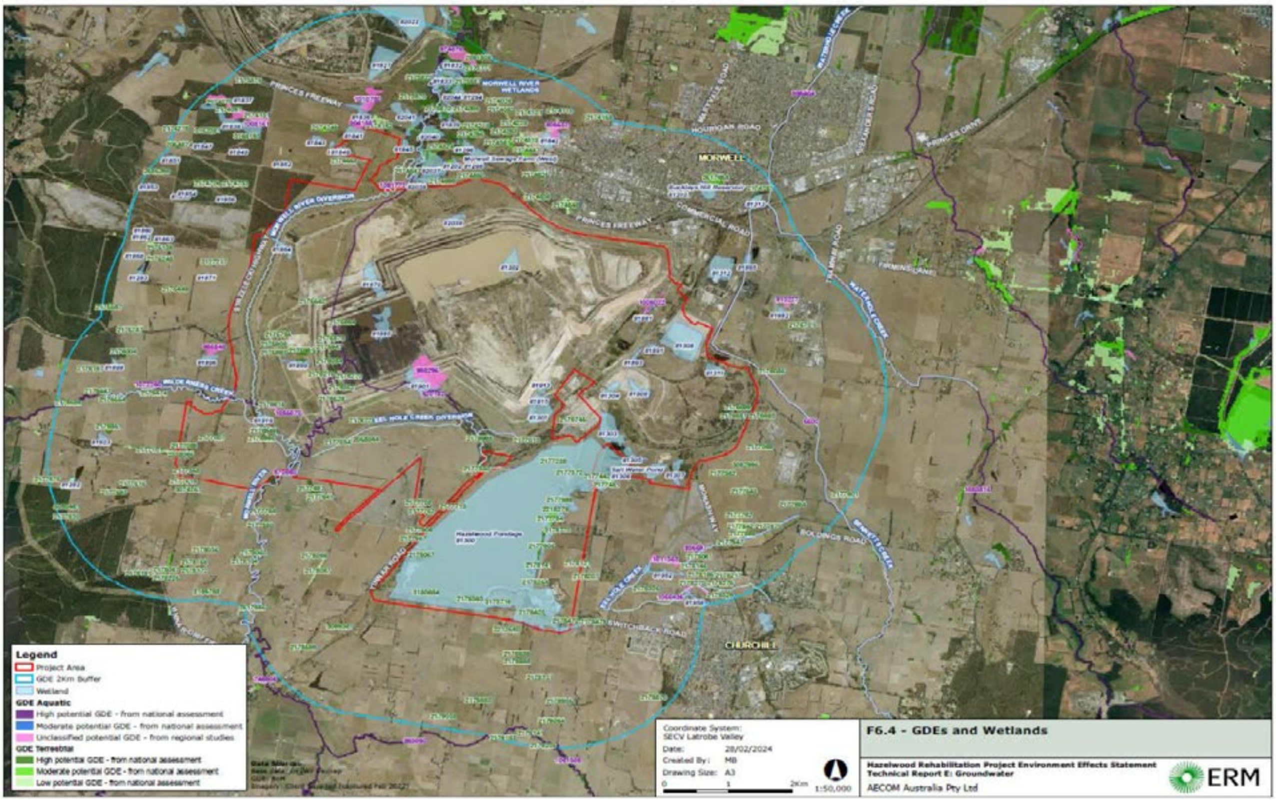

Figure 11.12: GDEs and wetlands within 2 km of the project area (extract of Figure 6.4 from ERM 2024)

Table 11.9: Modelled GDEs with high or moderate potential

GDE ID	DESCRIPTION (FROM ERM 2024)	ASSOCIATED LANDFORM FEATURES
AQUATIC GDES		
Morwell River (5581, GDE 1091772 and wetland ID 870860) / Middle Creek (wetland ID 746905) / Billy Creek (wetland ID 863060)	The portion of the Morwell River that was represented by diversion 3 and which is indicated to be located within the mine void is mapped as a high potential GDE, but this is not consistent with this being a constructed feature and much of diversion 3 has been removed and replaced with the current (diversion 5) alignment. Remnant portions of the original course of the Morwell River to the north are more likely to be influenced by Yallourn rehabilitation or changes to surface water, rather than groundwater. Portions of the Morwell River to the south of the mine void may remain as GDEs, including upstream of the project area.	Morwell River aquatic habitat Revegetation and some limited, highly degraded remnant vegetation (sometimes located adjacent to the river) generally dominated by eucalyptus tolerant of moist, wet environments. Adjacent areas are generally agricultural land dominated by exotic grass species.
Eel Hole Creek Diversion (Wetland ID 820182) / Eel Hole Creek (wetland ID 835597)	The former alignment of Eel Hole Creek Diversion has been removed by mining and the current Eel Hole Creek Diversion is not mapped as a GDE. Upstream of Eel Hole Creek there are also a number of wetlands e.g. 1011353 (wetland 81952) and 1055435 (wetland 81958);	Eel Hole Creek Diversion, aquatic habitat Revegetation and some limited, highly degraded remnant vegetation (sometimes located adjacent to the river) generally dominated by eucalyptus tolerant of moist, wet environments. Adjacent areas are generally agricultural land dominated by exotic grass species.
Bennett's Creek (5500)	-	Small drain / creek that has been realigned from historical course, flows in a north westerly direction. Some parts of Bennetts creek are now concrete lined, north and east of the study area. Likely to be seasonally ephemeral.
Waterhole Creek (99404 and 1083815);	-	Small Drain / Creek approximately 2-3 km east of the study area, flows north westerly direction. Generally dominated by low scrub and eucalyptus tolerant of moist, wet environments.
Wilderness Creek (1072260)	-	Small creek to the west of the study area that flows into the Morwell River Diversion. Some parts of Wildness Creek flow through densely wooded areas that are dominated by eucalyptus tolerant of moist, wet environments. Some open sections dominated by scrub and exotic flora.
1008022 (Wetland ID 81881)	Southeast of mine void, Morwell Main Drain above ground alignment	Swampy wet area with planted vegetation, some (few) trees may be remnant. Area appears to receive some inundation and thus vegetation here is likely to be tolerant of moist, wet environments.
1085070 (wetland ID 81919)	Southwest of the mine void. Adjacent Morwell River Diversion south-west of the mine void.	Isolated remnant of Wildness Creek former course. Remnant eucalyptus likely to be tolerant of moist, wet environments.
Wetland ID 81307	Constructed Brodribb Road wetlands	Revegetated wetland area containing areas of swamp scrub, wetland vegetation and planted eucalyptus tolerant of moist, wet environments.
Wetland ID 81899	Indicated to be a dam / storage in the mapping, appears to be a drainage line that is not clearly operational located west of the mine void	Listed in Victorian Wetland Inventory (Current) as a temporary freshwater swamp with episodic periodically inundation however this area is now highly modified open exotic grasslands adjacent to the mine void.
Wetland ID 81864	Northwest of the mine void – swamp scrub wetland	Patch of dense swamp scrub wetland likely represent remnant vegetation and landform.
Wetland ID 82039	North of the mine void – south of western overburden dump	Listed in Victorian Wetland Inventory (Current) as an artificial wetland swamp with episodic periodically inundation. Revegetated with that are likely to be tolerant of moist, wet environments.
Wetland IDs 81202, 81845 and 82037 – 82041	Morwell River wetlands downstream of the mine	Revegetated wetlands associated with the historic alignment of the Morwell River. Revegetated with species that are tolerant of moist, wet environments.
TERRESTRIAL GDES		
Around the Morwell River Wetlands e.g. 2174324, 2174647, 2174699 and 2174660	-	Revegetated wetlands associated with the historic alignment of the Morwell River. Revegetated with species that are tolerant of moist, wet environments.
Eastern edge of the HCP (e.g. 2177666, 2218276, 2177784, 319770, 2177905, 2178141 and 2178254)	Small areas on the margins of the Hazelwood Cooling Pond	Areas of vegetation that have since recolonised the edge of the HCP as the water recedes. A mix of native and exotic vegetation and consisting of shallow rooted herbaceous vegetation.
Other isolated patches of vegetation around the groundwater study area.	-	-
Western portion of the mine void (e.g. 2175694, 2175878, 2175947, 2176084, 2176215, 2176270, 2176352 and 2176528) and further to the west.	Those within the mine void would have been removed as part of the historic mining and are no longer present.	No longer present

10. Air quality

10.1 AMBIENT AIR QUALITY MONITORING DATA

Within the Latrobe Valley ambient air quality monitoring stations are operated by EPA Victoria and the Latrobe Valley Air Monitoring Network Incorporated (LVAMN). The location of these stations in relation to the Hazelwood site are shown in below and the parameters monitored are listed in Figure 11.13

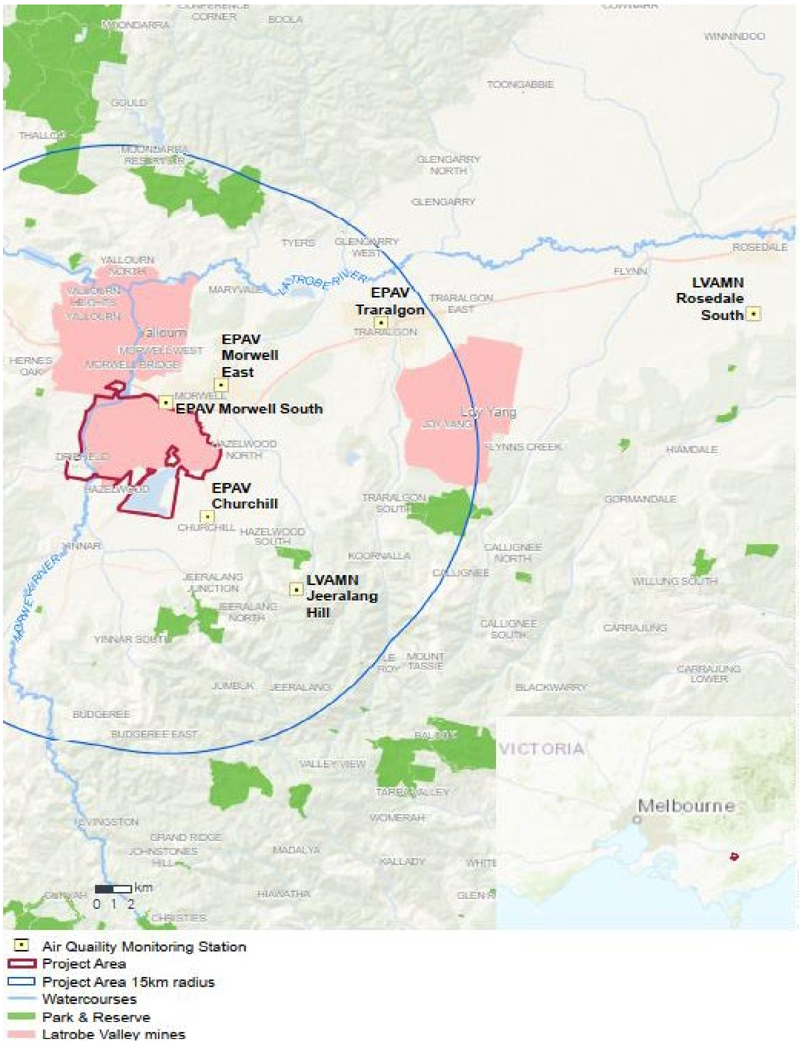

Figure 11.13: Location of EPA and LVAMN monitoring stations

The purpose of the EPA Victoria ambient air monitoring network is to ensure compliance with the federally mandated Ambient Air Quality under the National Environment Protection Measure (NEPM). These stations measure Environment Reference Standard (ERS) criteria pollutants CO, NO2, SO2, PM10 and PM2.5. The LVAMN stations measure NO2, SO2, PM10 and PM2.5. The location, dates of data availability and recorded parameters of all monitors are presented in Table 11.10.

Table 11.10: Summary of monitoring stations near or within the project area

MONITORING STATION	DATASET USED	POLLUTANTS MONITORED	DISTANCE FROM PROJECT AREA
EPAV Churchill	January 2016 - December 2021	PM2.5	~ 5 km south-east
EPAV Morwell East	January 2016 - December 2021	PM2.5, CO, SO2	~ 5 km north-east
EPAV Morwell South	January 2016 - December 2021	PM2.5, CO, SO2, NO2	~1 km north
EPAV Traralgon	January 2016 - December 2021	PM2.5, PM10, CO, SO2, NO2	~12 km north-east
LVAMN Jeeralang Hill	January 2016 - December 2019	PM10, SO2, NO2	~ 10 km south-east
LVAMN Rosedale South	January 2016 - December 2019	PM2.5, PM10, SO2, NO2	~ 40 km north-east

Note 1 PM10 monitoring has since commenced at Churchill and Morwell East in 2022, however has not been considered in this assessment

10.2 SUMMARY OF BACKGROUND AIR QUALITY CONCENTRATIONS

The Latrobe Valley has a well-documented background air quality due to numerous monitoring stations. Despite the presence of heavy industries, air quality generally meets ERS criteria and is often better than in metropolitan areas like Melbourne, with lower levels of PM10, PM2.5, and NO2. However, sulphur dioxide levels are elevated due to emissions from coal-fired power stations. In 2019 and 2020, particulate concentrations spiked due to hot, dry weather and bushfires, highlighting the impact of meteorology on air quality. These conditions are not typical long-term but can recur, suggesting that future hot, dry periods may elevate particulate levels. Mitigation strategies for projects in the area should consider scaling back activities during such conditions to prevent further increases in particulate concentrations.

10.3 EXISTING ONSITE LEVELS

PARTICULATE MATTERS

ENGIE Hazelwood monitors particulate concentrations in the form of PM10 and PM2.5, via seven monitoring stations onsite. The location of these monitoring stations is shown in Figure 11.14. The purpose of this monitoring is to provide air quality concentration data that is used as input into the site's trigger action response plan (TARP).

Figure 11.14: Location of onsite dust monitors, Hazelwood

10.4 AIR DISPERSION MODELLING FOR THE MINE REMEDIATION AND COAL ASH POND CLOSURES

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by ENGIE Hazelwood to develop a dust management plan for the Hazelwood Rehabilitation Project. ERM prepared a dispersion modelling report in 2019 to identify key emission sources and potential impacts on sensitive receptors during different phases of the project. The modelling included activities at the northern borrow pit, east field northern batters, central borrow pit, and west field southern batters. Emission sources identified were dozers, excavators, wheel-generated dust, truck rear dumping, graders, compactors, rollers, and wind-generated dust from exposed areas.

The worst-case scenario modelling for northern borrow pit and east field northern batters predicted that unmitigated dust emissions would exceed PM10 and PM2.5 criteria at nearby receptors, with significant contributions from haul roads and wind erosion. Mitigation measures such as watering haul roads, chemical spraying, limiting grader speeds, and water spraying during truck dumping were shown to significantly reduce dust levels. Monitoring data from recent years confirmed compliance with air quality criteria for most of the year, with occasional short-term exceedances during major earthworks.

11. Cultural Heritage

The Aboriginal cultural heritage assessment for the EES (Andrew Long & Associates, 2024) aims to identify and maximize beneficial outcomes related to Aboriginal cultural heritage values while minimizing adverse effects. A desktop assessment identified 89 previously registered Aboriginal places within the project area, indicating historical use by Aboriginal people, with scarred trees and artefact scatters found across the Morwell River system. However, extensive ground disturbance from mining activities has likely destroyed these places within the mine void.

Field surveys and subsurface archaeological investigations confirmed the desktop assessment's findings, noting significant ground disturbance outside the mine void from activities like river diversions and road construction. Minimal disturbance was observed along Eel Hole Creek, where additional Aboriginal cultural heritage was identified. No subsurface Aboriginal cultural heritage was found in the project area during these investigations.

The section of Eel Hole Creek in the southeastern corner of the cooling pond, constructed in the 1960s, has been impacted by the pond's construction and use. The receding water levels have exposed large sections of the creek bank, revealing surface Aboriginal cultural material likely accumulated through initial earthworks and erosion. Archaeological excavations confirmed the absence of topsoil and the presence of heavy clay deposits, with a very low likelihood of subsurface Aboriginal cultural heritage in these areas.

The impact assessment for the project identified key impacts on both intangible and tangible Aboriginal cultural heritage. The preparation of a Cultural Values Assessment (CVA) facilitated meaningful engagement with Traditional Owners, allowing their expertise to be incorporated into the rehabilitation design to minimize negative impacts on intangible heritage. For tangible heritage, a Cultural Heritage Management Plan (CHMP) will provide guidelines to assess and manage impacts on registered and unregistered Aboriginal heritage places, ensuring appropriate mitigation measures are in place.

12. Noise and Vibration

The land to the east, west and south of Hazelwood is sparsely populated and categorised as rural residential. As this land is generally quieter than urban and suburban areas, the introduction of novel noise sources can alter noise environments up to one to two kilometres. Morwell, located to the north of the project area is categorised as a suburban residential environment. The Princes Freeway runs between the township and the northern boundary of the project area. A small area of industrial land was also identified adjacent to the north-east boundary of the site.

12.1 UNATTENDED NOISE MONITORING

Unattended noise monitoring was conducted at six locations from September 1 to October 5, 2022, to understand existing conditions across the study area. Measurements were taken in open environments and checked against weather data to exclude those affected by adverse conditions like high winds or rain. Average background noise levels were calculated for day, evening, and night periods.

Generally, noise levels were low, except near the Princes Freeway where they were higher. Evening noise levels were slightly higher than daytime levels at some locations, possibly due to cicadas. Night-time noise levels were typical for rural areas, with some variation observed.

12.2 ATTENDED NOISE MONITORING

Attended noise monitoring was conducted in September 2022 Observations (Noise & Vibration, AECOM 2024) included sounds of insects, frogs, and wind through trees in rural areas, occasional road noise in Churchill, a low-frequency rumble from nearby industry at Porters Rd, and a quiet electrical buzz around the Hazelwood Terminal Station.

13. Public Safety

Consistent with conditions upon MIN5004, the Hazelwood Mine is enclosed within a continuously fenced boundary that is appropriately signed to deter unauthorised access. Fencing adjacent to public access areas is generally chain wire security fencing, while other areas of the site are post and wire farm style fencing.

Access to the mine site is controlled and monitored to ensure safety of the public and workers at the site. Vehicle access is generally confined to a controlled access gate off Hazelwood Drive. An access card system is used by site approved personnel and contractors. All other visitors and contractors requiring access to the site must obtain authorisation from appropriate ENGIE Hazelwood personnel and are issued with the visitor's permits at the access gate. A site induction must be completed by all persons attending and accessing the site for work / business purposes.

14. References

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