SECTION 9

Evaluation and Conclusion

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9 EVALUATION AND CONCLUSION

This section provides a summary evaluation and conclusion for the Project EIS. Consistent with the requirement of the SEARs, this section provides justification for why the Project should be approved.

As part of this justification consideration has been given to:

- the suitability of the site (Section 9.1);
- key engagement outcomes and associated Project design decisions and consideration of alternatives (Section 9.2);
- statutory requirements and planning policies (Section 9.3); and
- key impacts and benefits (Section 9.4).

9.1 SUITABILITY OF THE SITE

This sub-section describes the Project site with respect to five key aspects of suitability. However, the remainder of Section 9 also presents additional information that pertains to the suitability of the site and the more general suitability of the Project within the NSW environmental assessment and approval regime.

9.1.1 Existing Mining Tenements

The Dendrobium Mine currently extracts coal from the Wongawilli Seam within CCL 768 using underground longwall mining methods. CCL 768 is a large tenement, which incorporates a number of historical tenements that were consolidated over time, including areas of the previous Cordeaux Colliery.

The Dendrobium Mine has an approved operational capacity of up to 5.2 Mtpa of ROM coal until 31 December 2030 and includes five approved underground mining domains in CCL 768, named Areas 1, 2, 3A, 3B and 3C (Figure 2-3).

The presence of coal seams able to be economically mined in the vicinity of the Dendrobium Mine and within South32's mining and exploration tenements has determined the location of the Project.

The Project seeks the further extraction from CCL 768 of approximately 78 Mt of additional ROM coal sourced from the proposed Areas 5 and 6. The Project is a continuation and extension of the existing approved Dendrobium Mine underground mining activities within CCL 768.

9.1.2 Existing Surface and Underground Mine Infrastructure

Key surface facilities at the Dendrobium Mine (Figure 1-2) include the:

- Dendrobium Pit Top;
- Dendrobium Nos 1, 2 and 3 Shafts;
- Kemira Valley Coal Loading Facility;
- Kemira Valley Rail Line; and
- Dendrobium CPP located in Port Kembla.

The West Cliff Stage 3 Coal Wash Emplacement also comprises an approved component of the Dendrobium Mine (Figure 1-5).

The Project would make continued use of these significant existing surface facilities and associated systems such as electricity supply with some additional upgrades over the life of the Project. The use of existing Dendrobium Mine surface facilities by the Project maximises the potential benefits of previous South32 infrastructure investment and minimises potential new surface disturbance areas in comparison to a greenfield mine proposal.

Similarly, the Project would make use of the existing Cordeaux Pit Top, which has remained in limited use since the closure of the Cordeaux Colliery in 2001. Benefits to the Project of the re-use of this facility would include access to the existing major hardstand, existing site facilities, public road access, electricity supply and water management infrastructure for the development of Area 6, without the need for material additional land disturbance.

The Project would also continue to make use of the existing extensive underground mining infrastructure of the Dendrobium Mine. This underground infrastructure includes personnel and materials access systems, ventilation systems, electricity supply, gas drainage, coal clearance and water management systems, which represent significant capital investment by South32 over the life of the Dendrobium Mine. Project extensions and augmentations of underground infrastructure would also be undertaken progressively as required.

9.1.3 Proximity to BlueScope Steelworks

Proximity and Use of Existing Infrastructure

The steelworks at Port Kembla (referred to as the BlueScope Steelworks) was originally developed due to its proximity to the coal mines of the Southern Coalfield. South32 currently supplies the BlueScope Steelworks with approximately 60% of its metallurgical coal requirements.

The Project would continue to make use of the existing Kemira Valley Rail Line, which connects the Dendrobium Mine Kemira Valley Coal Loading Facility directly to Port Kembla. The Dendrobium CPP is located in the Port Kembla industrial precinct (regulated under the BlueScope Steelworks EPL 6092) and South32 pays a fee to BlueScope Steelworks for the use of the facility.

The continued use of this existing infrastructure for the Project would allow the existing integration between the Dendrobium Mine and the BlueScope Steelworks to continue.

Economic Significance of the Steelmaking Industry

Steel remains a fundamental material for a variety of construction and manufacturing industries, and domestic steelmaking is a strategically valuable asset for Australia's economic security and prosperity.

The importance of local (i.e. Australian) steelmaking is described in the Parliamentary Report *Australia's Steel Industry: Forging Ahead* (Commonwealth of Australia, 2017), which outlines the safety benefits and economic significance of the steel industry to the Australian economy and regional economies where steelmaking facilities are located. In the Illawarra region, the BlueScope Steelworks (Commonwealth of Australia, 2017):

- directly employ 3,000 people;
- indirectly support about 10,000 jobs in the region (with the Illawarra Business Chamber noting in its submission to the Report that the multiplier effect of the steel industry is 3 to 5 indirect jobs for every direct job generated by the industry); and
- contribute approximately $1.9 billion per annum to the economy, based on analysis conducted by Wollongong City Council (without considering any multiplier effect).

The BlueScope Steelworks at Port Kembla is the largest steel production facility in Australia, and one of only two primary iron and steelmaking facilities in Australia.

Use of Coal in Steel Production

Metallurgical coal is a raw material that is essential for the manufacture of 'virgin iron' and steel (also known as 'primary steelmaking' or 'integrated steelmaking'). The other key raw material is iron ore.

While the BlueScope Steelworks produces a portion of its steel using recycled scrap steel as a feed stock, there is not sufficient supply of scrap steel to meet demands, and therefore the steelmaking process continues to require the use of metallurgical coal and iron ore.

Metallurgical coal is used as a reducing agent in the steelmaking process. The carbon in the metallurgical coal is used to convert iron ore to molten iron in a blast furnace.

Research into the use of alternative reducing agents in the blast furnace method, such as hydrogen, is being undertaken. However, there is currently no economically viable alternative to the use of metallurgical coal as a reducing agent in the blast furnace method (i.e. a method employed at the BlueScope Steelworks) at a commercial scale (BlueScope Steel Limited, 2019).

Importance of Local Metallurgical Coal Supply

The steelmaking industry is highly trade exposed, with Australian steelmakers competing against suppliers across the globe. Accordingly, maintaining low production costs are critical to the competitiveness and viability of the Australian steelmaking industry.

The proximity of the existing Southern Coalfield mines, including Dendrobium Mine, to BlueScope Steel's facilities at Port Kembla is a factor in BlueScope Steel's ability to make economically competitive steel.

BlueScope has previously noted that without local metallurgical coal suppliers it may struggle to remain economically viable at Port Kembla (BlueScope Steel Limited, 2019).

The ACCC (2017) also noted the disadvantages the BlueScope Steelworks may face if it were required to source metallurgical coal from the Bowen Basin in Queensland (rather than the Illawarra region):

> *… there is significant additional cost associated with transporting substitutable coking coal from alternative sources to the Australia steelmakers as well as potential capacity constraints limiting the ability of one steelmaker to import large volumes of coal by ship.*
>
> *…*
>
> *In relation to transportation costs, BlueScope would incur significantly higher freight logistics costs to ship coal from the Bowen Basin via the Queensland coal exporting ports to its steel mill at Port Kembla compared to the costs associated with the supply of coal from South32 and Metropolitan's mines in the Illawarra to its steelworks at Port Kembla. Market inquiries indicate that the cost of transporting coal from the Bowen Basin to Port Kembla is likely to be between $US10-15 per tonne.*

In addition, coal from the Southern Coalfield is supplied to the BlueScope Steelworks on a 'just-in-time' arrangement via daily rail or truck deliveries. Coal stockpiles for feed to the Dendrobium CPP, located at Port Kembla, and steelmaking process are depleted on a weekly basis. Some coal to the BlueScope Steelworks is supplied by ship, with port facilities operating at high utilisation levels.

Any increase in seaborne coal supply to the BlueScope Steelworks would require substantial capital investment in additional port facilities (estimated to be at least $150 million) and stockpiling facilities, with the additional logistics costs estimated to be between $50 million and $100 million per annum (BlueScope Steel, 2019).

The continued supply of coal from the Dendrobium Mine to the BlueScope Steelworks, which would be facilitated by approval of the Project, would contribute to its ongoing economic viability and associated socio-economic benefits.

9.1.4 Access to Port Infrastructure

The Dendrobium Mine's existing direct rail access to the Port Kembla industrial precinct also facilitates the transport of Dendrobium product coal to other Australian customers (including the Liberty Primary Steel Whyalla Steelworks) and international customers, via the Port Kembla Coal Terminal. South32 is the manager of the Port Kembla Coal Terminal on behalf of the six operating shareholders which also include Glencore, Centennial Coal, Wollongong Coal, SIMEC Mining and Peabody.

Under the Project, Dendrobium Mine product coal would continue to be transported from the Port Kembla Coal Terminal to Australian and international customers.

The continued operation of the Dendrobium Mine, should the Project be approved, would support the continued operation of the Port Kembla Coal Terminal, which currently employs approximately 80 personnel.

As the Port Kembla Coal Terminal is a fully funded multi-user facility (with South32 the major user), reduced throughput of South32 coal would affect other users, as their costs would increase.

9.1.5 Drinking Water Catchments

The Project would represent the continuation of mining in the Metropolitan Special Area. Mining has occurred in the Special Catchment Areas (which includes the Metropolitan Special Area) for over a century. As noted by the IEP (2018), there has been no observed material impacts to drinking water supplies due to mining in these catchments:

> *Reservoir leakage rates – there is no measured evidence of significant long-term leakage from reservoirs due to mining in the Special Areas.*
>
> *…*
>
> *Watercourse bed leakage (at catchment scale) – from material presented to the Panel, there remains no strong evidence that cracking of watercourse beds leads to significant losses of water at catchment scales relevant for water supplies.*

The Dendrobium Mine Development Consent (DA 60-03-2001) requires that there is no greater than negligible reduction in the quality or quantity of Cordeaux Dam and Avon Dam, and South32's operations at the Dendrobium Mine continue to comply with this requirement.

This indicates South32's mine planning processes, which set back longwall panels from the reservoirs and major watercourses at the Dendrobium Mine, have been successful to date with respect to protecting water supplies, and this would continue for the Project.

The socio-economic benefits to NSW and the region from underground mining in the catchment areas are significant, including in consideration of the interdependence between the BlueScope Steelworks, the Port Kembla Coal Terminal and continuation of mining for the Project (Section 9.1.3). It is also noted that, given the access restrictions to the Metropolitan Special Area, underground mining is the only major development that can coexist in the catchment areas given its limited surface impacts.

The coexistence between underground mining and the provision of drinking water supplies in the Metropolitan Special Area is expected to continue should the Project be approved.

9.2 KEY ENGAGEMENT OUTCOMES AND ASSOCIATED PROJECT DESIGN

Regulatory and public engagement by South32 for the Project (Section 5) has identified the following key assessment issues for the Project:

- Mine subsidence effects and associated potential impacts on:
  - water supply yield and quality;
  - water supply infrastructure;
  - the interaction of groundwater and surface water resources;
  - upland swamp drying and wetting cycles and associated plant species distribution; and
  - riparian and aquatic habitats due to alterations to surface water flows.
- Potential impacts of direct land disturbance on biodiversity and heritage values.
- Potential impacts of the continuation of existing Dendrobium Mine surface facilities.
- Potential continuation and extension of the Dendrobium Mine's positive impacts on employment, regional expenditure and royalties.
- The importance of local metallurgical coal supplies to the operation and socio-economic benefits of the BlueScope Steelworks.

Key potential adverse impacts can be generally grouped into: impacts related to underground mining subsidence and associated impacts on the overlying physical environment; and impacts of the surface activities of the Dendrobium Mine that are not related to mine subsidence (noting that the Project maximises the use of the existing surface infrastructure of the Dendrobium Mine).

Key potential benefits of the Project identified in engagement were largely socio-economic in nature. It is noted that potential adverse social impacts were not generally raised as a concern for the Project (Section 5 and Appendix K) due to the large regional population and the proposed continuation/extension of the existing Dendrobium Mine workforce and operations.

A number of alternatives to the Project have been considered by South32 in the development of this EIS in light of engagement feedback.

An analysis of feasible alternatives to the Project considered by South32 is provided below, in accordance with clause 7 of Schedule 2 of the EP&A Regulation (Table 1-3) and requirements pertaining to assessment under the Commonwealth EPBC Act (Attachment 2).

9.2.1 Mine Subsidence-Related Impacts

Concerns relating to mine subsidence effects, and particularly associated impacts on hydrology, aquatic ecology and biodiversity in the Special Catchment Areas have been raised by regulatory authorities, members of the public and some non-government agencies. Key Project alternatives considered with respect to these aspects are discussed below.

Mining Method

The Dendrobium Mine currently uses conventional longwall underground mining methods to extract coal from the Wongawilli Seam (Section 2). The Project would extract coal from both the Bulli and Wongawilli Seams, neither of which could be mined economically by open cut mining methods given the seam depths. In addition, open cut mining would not be compatible with other land uses in the Project extent of longwall mining areas, such as water supply catchment and conservation.

Open cut mining was therefore not considered to be an option for the Project.

While bord and pillar mining is an underground mining technique that can be viable for some shallow coal seams, it is uneconomic in Australia to use bord and pillar mining as the primary production method at depths from the surface that are greater than about 200 m (DoP, 2008).

Longwall mining is also recognised as a safer mining method compared with bord and pillar. The Southern Coalfield Panel Report (DoP, 2008) stated:

> *Safety, productivity and cost considerations dictate that longwall mining is now the only major, viable, high production mining method in the majority of Australian underground coal mines that operate at a depth of greater than about 300 m and in virtually all new coal mines (irrespective of depth).*

The depth of the Bulli and Wongawilli Seams in the Project extent of longwall mining area range from approximately 250 m to 390 m and 375 m and 460 m from the surface, respectively.

When considering safety, productivity and costs, longwall mining is considered to be the only viable mining method for the Project.

Longwall Panel Width

Dendrobium Mine currently operates with longwall panels up to 305 m wide and this would continue under the Project.

South32 has considered the option to adopt narrower longwall panels for the Project (such as the 163 m wide panels adopted by Metropolitan Mine), in which case there would be some reduction in total vertical surface subsidence, and some corresponding reduction in predicted tilts and strains. There would also be some reduction in the height of connective fracturing and associated groundwater depressurisation above the longwalls, which may reduce or negate the proportion of surface water flows from overlying streams reporting to deeper groundwater systems, and ultimately into the mine water management system.

However, with narrower longwall panels it is clear that subsidence impacts would still be expected to occur to streams and upland swamps overlying the Project longwall panels, particularly the potential for surface cracking at controlling rockbars that retain water to form in-stream and upland swamp features.

The potential for losses in surface flow and diversion of water from the bases of pools and/or upland swamps would therefore be largely unchanged by the adoption of narrower longwall panels, as the effects of subsidence would still be above thresholds at which subsidence impacts on rockbars, pools and upland swamp hydrology have been observed.

It is noted that environmental externality costs associated with predicted losses of surface water would be internalised by South32 by the proposed payment for the estimated take to WaterNSW (Section 8).

Adoption of narrower longwall panels for the Project would still require South32 to apply the same compensatory and offset measures to address potential impacts to water quality, aquatic ecology and upland swamps that have been adopted for the proposed 305 m wide Project longwall panels.

The net effect of adopting narrower panels for the Project would be a material reduction in the recovery of coal and an increase in the cost of mining, with associated reductions in economic benefits to NSW and increased production costs to South32.

It is noted that efficient resource recovery is a consideration of the NSW Government in the evaluation of mining projects.

The Dendrobium Mine achieves an areal extraction efficiency of 87%, in comparison to the Metropolitan Mine's areal extraction efficiency of 78% where narrower longwall panels are being applied (IEP, 2018). Accordingly, it can be inferred that benefits to NSW associated with royalty payments would also reduce by approximately 9% (equivalent to a reduction of approximately $21 million in NPV terms).

With reduced panel widths, longwall development metres per longwall metre would increase significantly, and the associated costs per tonne of coal recovered would also increase.

The value of the Project to South32 and the net benefit to the State of NSW would be significantly reduced if narrower panels were adopted for the Project, but the cost of environmental externalities would be effectively unchanged.

As the costs of surface water diversion would be internalised for the Project (i.e. payment for water take to WaterNSW), any decrease in the loss of surface water associated with narrower panels would result in an associated decrease in payments to WaterNSW.

Narrower panels would result in significant adverse impacts to the economic viability of the Project and continued operations of the approved Dendrobium Mine. Economic benefits potentially forgone if the Project does not proceed amount to a net benefit of $1,073 million in NPV terms to the State of NSW and $431 million in NPV terms to the greater Wollongong Region (Appendix L). This includes an estimated $272.1 million in royalties, payroll tax and council values in NPV terms.

South32 has therefore elected to maintain the current panel width of the Dendrobium Mine (up to 305 m) for the proposed extraction of coal in Area 5 and Area 6 under the Project.

Longwall Layout

The longwall layout proposed for the Project (Section 3) has been designed by South32 to reflect adoption of a number of longwall mine constraints to minimise impacts, including setbacks from the Avon and Cordeaux Dam walls, a minimum 300 m longwall setback from the existing dam FSLs, and setbacks from named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek) (Section 3). South32 is also avoiding the direct undermining of mapped 'key stream features' identified during site investigations (Section 3).

Varying longwall geometry (such as longwall width, longwall length and pillar width) can affect the development and expression of subsidence effects at the surface. When individual longwalls are reduced in overall length, the amount of coal left *in-situ* within a mining domain increases and subsidence movements (including systematic tensile and compressive strains) at the surface can be generally reduced, although there may be some localised exceptions.

Reducing the overall length of longwalls can, therefore, result in some reduction in the scale of subsidence effects that occur at the surface. However, it is important to consider whether any such reduction would also be accompanied by any material change in the environmental consequences that arise from mine subsidence. This has been considered in Appendix A.

For the Project, three longwall layout alternatives have been considered. Alternative layouts considered the potential subsidence impacts where longwalls mine directly beneath all streams (maximum longwall overall length) and where the longwalls were setback from all upland swamps (minimum longwall overall length), as well as the EIS base case longwalls, which represents the Project proposal based on South32's adopted mine design constraints (Section 3, Section 6 and Appendix A).

Longwall Layout – 'Maximum' Case

The 'maximum' case longwall layout considered in Appendices A and L includes mining of additional economically recoverable coal reserves within CCL 768 in Project Area 5 and Area 6.

Compared to the setbacks adopted for the Project longwall layout, the 'maximum' case mine plan adopts reduced setbacks from the Avon and Cordeaux Dam walls and FSLs of 500 m and 150 m respectively, and does not apply specific setbacks from named watercourses or key mapped stream features.

The 'maximum' case mine plan is predicted to result in increased subsidence and closure, particularly along named watercourses and key mapped stream features, with associated increases in the likelihood of impacts to stream features (e.g. pools) (Appendix A). On the basis of the increase in the potential for impacts to these features, this is not the preferred longwall layout for the Project.

However, it is noted the 'maximum' case would result in increased coal output of 19.2 Mt ROM coal over the life of the Project with an estimated increase in net benefits to NSW of approximately $82 million in NPV terms (comparing the two scenarios with both including the completion of mining in Area 3C) (Appendix L).

Longwall Layout – 'Minimum' Case

The 'minimum' case longwall layout considered in Appendices A and L adopts the mine design constraints for the Project longwall layout (Section 3), and in addition, includes setbacks from all upland swamps of 50 m from the ends of longwalls and 100 m from the sides of longwalls (Appendix A).

The 'minimum' case longwall layout is predicted to result in similar vertical subsidence and closure at named watercourses and the drainage lines that overlie the longwalls (Appendix A).

Based on analysis of upland swamp monitoring data from the Dendrobium Mine significant changes in upland swamp hydrology would not be expected for upland swamps more than 60 m from the longwalls (Appendix D) and therefore a reduction in the likelihood of impacts to upland swamp hydrology would be expected based on the 'minimum' case longwall layout, noting that the likelihood of impacts would not be nil.

However, the 'minimum' case would result in a reduction in coal output of 21.2 Mt of ROM with an estimated decrease in net benefits to NSW of approximately $220 million in NPV terms (compared to the Project longwall layout plus the completion of mining in Area 3C) (Appendix L).

This reduction in coal output and associated economic benefit is not considered to be reasonable given:

- The Swamp Offset Policy (OEH, 2016a) provides the framework for offsetting potential impacts to upland swamps from longwall mining. It requires consideration of avoidance and minimisation methods with offsets to compensate for impacts of longwall mining where it can be demonstrated that all feasible measures to avoid and minimise impacts have been taken.
- The Project has considered measures to avoid potential impacts to upland swamps through:
  - The selection of proposed mining in Areas 5 and 6 as opposed to Area 4 (refer to the discussion below) in addition to siting surface infrastructure to avoid direct impacts to upland swamps.
  - Alternative longwall geometry/methods within Areas 5 and 6 have been considered (refer to the discussion above in regard to narrower longwall widths), however, no material difference in the potential for impacts to upland swamps associated with alternative longwall layouts is expected.
  - The implementation of the mine constraints for the Project (Section 3) would result in avoidance of directly undermining a number of upland swamps including Den124, Den115, Den131, Den132, Den119 and Den134.
- The 'minimum' case longwall layout considers the avoidance of direct undermining of all upland swamps, however, while this scenario is technically feasible it is not considered to be reasonable given the significant reduction in resource recovery and associated reduction in economic benefits to NSW (a reduction of $220 million in NPV terms compared to the Project longwall layout plus the completion of mining in Area 3C).
- The potential impacts of the Project to upland swamps based on the proposed longwall layout can be summarised as follows:
  - While the Project longwall layout may result in changes to upland swamp hydrology for upland swamps within 60 m of the longwalls (i.e. longer dry periods due to an increase to rate of water level recession following rainfall), many upland swamps overlying Areas 5 and 6 currently experience drying and wetting cycles (Appendix D).
  - Based on monitoring data from previously undermined upland swamps at the Dendrobium Mine (and other mining operations in the Southern Coalfield), changes in upland swamp hydrology as a result of subsidence are not expected to result in significant changes to the extent of upland swamp vegetation and species composition (Appendix D).
  - The contribution of upland swamps to total predicted stream flow loss due to the Project has been investigated, and is predicted to be minor (i.e. avoidance of directly undermining upland swamps would not result in a material reduction in predicted stream flow loss) (Appendix C).
- Residual predicted impacts to upland swamps due to the Project longwall layout are therefore proposed to be offset via the Project biodiversity offset strategy (Section 6) consistent with NSW and Commonwealth Government policy. This includes offsets for potential subsidence impacts to TECs associated with upland swamps, as well as offsets for threatened fauna species for which the upland swamps provide habitat (Appendix D).

Review of Longwall Layout during the Project Life

As a component of the Extraction Plan process, the longwall layout would be reviewed and determined to achieve the Project longwall layout constraints and environmental outcomes prescribed in the Project Development Consent, while maximising South32's economic return on investment and associated socio-economic benefits.

The development of longwalls with optimised length has advantages with respect to a number of aspects of the mining operation, including:

- higher rates of coal extraction are achievable within a mining domain, and hence the efficiency of recovery of the State's coal resource can be achieved;
- depending on layout, the number of longwall moves (i.e. to relocate the longwall machine at the end of each longwall) can be reduced and hence costs, safety hazards and downtime associated with these moves can be minimised; and
- longer longwalls and reduced numbers of longwall moves allow proponents to increase annual ROM coal production rates per longwall machine and hence improve mining efficiency and associated economic benefits.

In the event that monitoring and/or further assessment during operations indicates the potential environmental impacts associated with mine subsidence may be approaching or are expected to exceed those authorised for the Project, adaptive management measures would be applied. Such adaptive management measures would include potentially reducing longwall length or increasing pillar widths to reduce subsidence impacts at the surface.

To minimise future uncertainty in regard to the potential environmental impacts presented in this EIS, a number of conservative assumptions have been included in modelling and assessment, including:

- Impacts on biodiversity in all streams directly overlying the Project longwalls and immediately downstream would be offset in accordance with the FBA based on the conservative assumption that all sections of stream are adversely impacted and require offsets, irrespective of the proposed Project longwall setbacks for key stream features (Sections 3 and 6).
- The groundwater modelling has conservatively assumed fracturing and groundwater depressurisation above the longwalls greater than what would be predicted if the Tametta Equation was applied (Appendix B), noting the IEP (2018) recommends the adoption of the Tametta Equation to "*err on the side of caution".* This, and other conservative assumptions adopted in the groundwater modelling, indicates that the predicted groundwater inflows to the mine workings and associated potential losses of surface water from streams and the reservoirs presented in Appendices B and C are also likely to be conservative.

Future Water Supply Infrastructure

The SEARs for the Project require consideration of input to the SEARs from WaterNSW, which state that potential impacts on "future water supply infrastructure" should be assessed.

In subsequent correspondence (letter dated 28 February 2018) WaterNSW advised South32 that one of the long-term water supply options under consideration by WaterNSW is the "Lower Cordeaux Scheme" comprising the following new infrastructure:

- the Lower Cordeaux Dam;
- a tunnel from Burrawang (e.g. the existing Wingecarribee Reservoir) to the existing Avon Dam;
- a tunnel from the existing Avon Dam to the new Lower Cordeaux Dam; and
- a tunnel from the new Lower Cordeaux Dam to existing Broughtons Pass Weir.

Limited detail on the conceptual infrastructure was provided by WaterNSW, however, a conceptual drawing was provided showing the indicative footprint of the conceptual Lower Cordeaux Dam and indicative alignment of the Avon Dam to Lower Cordeaux Dam to Broughtons Pass Weir tunnels. The locations of this infrastructure based on the conceptual layout provided by WaterNSW relative to the Project longwalls is provided on Figure 6.18 of Appendix A.

The Project is not expected to be incompatible with this potential infrastructure.

The potential Lower Cordeaux Dam Wall is located on the Cordeaux River approximately 2.8 km west of the proposed longwalls in Area 6 and approximately 3.7 km north of the proposed longwalls in Area 5. At these distances, MSEC (2019) predicts the potential dam wall is not expected to experience measurable far-field horizontal or valley-related effects.

The potential tunnel from Burrawang to the existing Avon Dam would not be affected by the Project. The potential tunnel from Avon Dam to the potential Lower Cordeaux Dam could be affected by subsidence from the proposed Project Area 5, however, any such tunnel could be designed to accommodate subsidence-related movements if constructed prior to mining (Appendix A).

The FSL of the potential Lower Cordeaux Dam could overlap small areas of the Areas 5 and 6 longwall footprints, as well as previously mined areas associated with Area 2, Area 3 and other historic mining operations. The mining constraints proposed for the Project (Section 3) associated with setbacks from named watercourses and key stream features already limit the overlap between the Project longwalls and the potential FSL. It is noted the FSL of the potential Lower Cordeaux Dam would flood a number of features the Project seeks to protect via its mine design constraints (e.g. sections of Wongawilli Creek and Donalds Castle Creek would be inundated).

Mining in Project Areas 5 and 6 may affect the permeability of the overlying overburden, and increase the potential loss of water where the FSL of the potential Lower Cordeaux Dam overlaps areas of increased permeability. However, any potential water losses are likely to be negligible (less than 1%) compared to total dam water yield.

It is understood that the potential Lower Cordeaux Dam would still be subject to cost-benefit analysis (including comparison to other water supply options), feasibility studies, environmental assessment and planning approval, detailed design and construction. Should the potential Lower Cordeaux Dam be constructed during or prior to longwall mining in either Area 5 or 6, it would likely be a prescribed dam under the *Dams Safety Act, 2015*. Therefore, irrespective of any Development Consent for the Project, approval from the NSW DSC would be required for any mining within DSC Notification Areas, should the potential Lower Cordeaux Dam be prescribed.

No further mining constraints, beyond those already proposed for the Project (Section 3), are considered to be required for the potential water supply infrastructure at this stage, given that:

- There is significant uncertainty in regard to the feasibility, design, approvability and timing of the potential infrastructure.
- The Project is not expected to be incompatible with the potential infrastructure, should it be approved and constructed.
- The existing legislative requirements under the *Dams Safety Act, 2015* would require South32 to obtain approval from the DSC for any mining within any DSC Notification Area for the potential Lower Cordeaux Dam (should it be constructed) post-consent at the Project Extraction Plan stage.

Alternative Mining Domains

Area 3C

Longwalls within the approved Area 3C mining domain (beyond proposed Longwalls 20 and 21) would be mined during the life of the Project, between Areas 5 and 6 (Section 3).

The yet to be mined Area 3C accounts for a total of 16.1 Mt of ROM coal. For Area 3C to be mined, significant gas drainage works would be required, and in the absence of the Project, there would be a discontinuity of mining at the Dendrobium Mine following the completion of mining in Area 3B and Longwalls 20 and 21, which would adversely affect the economic viability of the remainder of Area 3C (Section 3).

On this basis, the Project is required to commence in Area 5 prior to the completion of mining in Area 3C.

Area 4

South32 has previously identified an additional potential mining domain (Area 4) in CCL 768, which is located to the north of the Dendrobium Mine approved Areas 1-3 (i.e. extending north from the Cordeaux Dam FSL to the CCL 768 boundary), including areas to the north and south of Picton Road.

When the naming of potential Dendrobium Mine mining domains initially occurred, this domain was identified as the next planned development area for the Dendrobium Mine after the completion of Area 3. However, based on South32's current evaluation of potential environmental, mining and infrastructure constraints (e.g. the number of upland swamps), Area 4 has been assigned lower priority for development than Area 5 and Area 6, which are the subject of this EIS.

In the future, Area 4 may be the subject of a separate development application based on South32's evaluation of the potential costs and benefits of the development of Area 4 coal resources at that time.

9.2.2 Surface Facilities Related Impacts

Concerns relating to the continuation and extension of the operation of Dendrobium Mine surface facilities and particularly impacts associated with controlled water releases, ventilation shafts, greenhouse gas abatement, rail noise and dust emissions from the Kemira Valley Rail Line, coal wash disposal and final land use have been raised by regulatory authorities, members of the public and some non-government agencies.

Key Project alternatives considered with respect to these aspects are discussed below.

Management of Surplus Water

Project water management studies (Appendices B and C) indicate that the expansion of the Dendrobium Mine would be accompanied by increasing mine inflows, which would increase the volume of water to be transferred off-site for disposal or beneficial reuse. This may require augmentation or duplication of some water management infrastructure to accommodate increased mine inflows.

In particular it is anticipated that the existing excess water pipeline that follows the Kemira Valley Rail Line to the licensed discharge point to Allans Creek (LDP5) under EPL 3241 at Unanderra may need to be upgraded, replaced or duplicated.

This pipeline may also be extended to the Port Kembla industrial precinct within existing infrastructure corridors to provide industrial water for beneficial reuse over the life of the Project.

South32 has investigated the beneficial reuse of mine water at its operations. However, the Dendrobium CPP currently uses recycled water from the BlueScope Steelworks and other Dendrobium Mine operations already maximise the reuse of mine inflows to meet operational demands. On this basis, further reuse of mine water by South32 is not required and opportunities to transfer this water to third parties are being investigated.

South32 would pursue potential re-use opportunities with major water users in the Port Kembla industrial precinct and surrounds, with the objective that the beneficial re-use of Dendrobium Mine excess water would reduce these operation's requirement for water currently supplied by Sydney Water.

Over the life of the Project, South32 would target a greater volume of excess Dendrobium Mine water being diverted to beneficial re-use than is diverted from drinking water reservoirs due to subsidence-related groundwater depressurisation.

If this is achieved, then the re-use of excess mine water would offset the predicted (negligible) loss of drinking water supply as a result of the Project (Section 6).

Ventilation Shafts

Consistent with the existing Dendrobium Mine surface disturbance procedures, Project ventilation shaft sites (i.e. Shaft Nos 5A, 5B, 6A and 6B) have been located to avoid disturbance to mapped TECs and known Aboriginal heritage sites.

Ventilation shaft sites have been sited in close proximity to existing fire trails to minimise land disturbance associated with vehicular access, and each site was designed to avoid any disturbance of mapped Shale Sandstone Transition Forest TEC and upland swamps (Appendix D and Section 8).

The proposed ventilation surface infrastructure for the Project has also been designed to avoid all known sandstone shelters, axe grinding grooves and natural landscape features (Appendix F and Section 8).

ROM Coal Transport Hours of Operation

All ROM coal produced by the Dendrobium Mine is transported by a rail transport contractor to the Dendrobium CPP via the Kemira Valley Rail Line. These existing rail operations are currently approved to 2030.

The Kemira Valley Rail Line preceded the Dendrobium Mine as it was supporting infrastructure associated with the preceding Kemira Colliery. Many residential areas in Mount Kembla, Cordeaux Heights and Cringila that are in close proximity to the Kemira Valley Rail Line were constructed after the Rail Line was developed.

Noise associated with rail operations on the existing Kemira Valley Rail Line has historically been a source of complaints from local residents in Mount Kembla and Cordeaux Heights. In particular, these complaints related to brake and wheel squeal noise.

In 2015, South32 trialled and implemented a range of improvements to braking activities on the Kemira Valley Rail Line to reduce brake and wheel squeal noise and a detailed investigation into brake and wheel squeal noise impacts was undertaken by Transport for NSW, in partnership with Pacific National, from December 2015 to July 2017 (Appendix J).

Based on the rail noise investigation outcomes, all trains operating on the Kemira Valley Rail Line were modified with new brake pads during the 2018 annual reporting period.

Subsequent noise monitoring has shown a significant reduction in rail noise levels due to brake squeal events, and a reduction in the number of brake squeal events (Appendix J). This reduction in rail noise was accompanied by a significant reduction in the number of rail noise complaints received (Section 6.14.3).

Notwithstanding, in support of this EIS South32 has undertaken a review of the current capacity, locomotive and wagon configuration and the feasibility of potential reduction to the hours of operation of the Dendrobium Mine coal trains on the Kemira Valley Rail Line.

Rail Movements Under Current Arrangements

ROM coal from the Dendrobium Mine is currently transported using three 22-wagon trains with a nominal capacity of 1,650 t per train. Up to approximately 3,150 train movements per annum are required to transport ROM coal at approved maximum production rates.

Rail availability is limited to approximately 46.5 weeks per annum, due to longwall outages, maintenance outages and other typical delays/constraints.

Based on the approved hours of operation for the Kemira Valley Rail Line (6.00 am to 11.00 pm) and the current rail cycle time of approximately 4.2 hours, a theoretical maximum of 12 rail journeys per day is possible.

However, loading/unloading infrastructure at the Dendrobium CPP is shared with BlueScope Steelworks trains, which limits the maximum number of train paths available to the Dendrobium Mine. The practical number of rail journeys is therefore generally limited to 10 rail journeys per day when BlueScope Steelworks trains are in operation.

Based on achieving 10 rail journeys each day, trains would need to be in full operation for approximately 45 weeks of the maximum available 46.5 weeks per annum (approximately 97% utilisation) to transport the approved 5.2 Mtpa of Dendrobium Mine ROM coal.

Therefore, it would not be feasible to maintain the proposed Project ROM coal production rates under reduced ROM coal transport hours and also maintain current contractual arrangements and infrastructure.

ROM Coal Storage Capacity at Dendrobium CPP

Coal processing at the Dendrobium CPP occurs 24 hours per day, seven days per week.

Sufficient storage capacity for ROM coal is required at the Dendrobium CPP to allow for continued coal processing outside of the permitted hours of operation for ROM coal transport (i.e. currently seven hours from 11.00 pm to 6.00 am).

ROM coal is preferentially stored in CPP feed bins rather than the coal stockpile area. Rehandling of coal in the stockpile area increases the percentage of fines material in the ROM coal, which then reduces the efficiency of the coal washing process.

Any changes in the current transport arrangements that reduce the hours of ROM coal transport would also necessitate upgrades at the Dendrobium CPP. These upgrades would include the construction of additional and/or larger feed bins and associated conveyors and other ancillary infrastructure.

The cost of these upgrades would be in the order of $4 million, and would be additional to the cost of other upgrades to the rail system that may be required to support any change to rail hours.

Consideration of Alternatives to Improve Rail Efficiency

It is considered the following constraints on the Kemira Valley Rail Line cannot be feasibly improved:

- rail availability, because longwall outages, maintenance outages and other delays are mining and maintenance related and are based on previous operational experience;
- interactions with BlueScope Steelworks trains, because there is insufficient space at the Dendrobium CPP to construct new loading facilities and an additional rail line; and
- travel times, as trains currently travel at the maximum safe speed on the Kemira Valley Rail Line.

Options to potentially improve rail efficiency, and therefore reduce the required rail hours, include:

- construction of an additional passing lane to allow for additional trains; or
- increasing train capacity through additional and/or larger sized wagons.

The construction of a passing loop or passing lane on the Kemira Valley Rail Line could allow for use of an additional train, which may allow for reduced hours of rail operation. However, South32 does not consider this option to be reasonable given that:

- there is insufficient space along the Kemira Valley Rail Line to construct a passing loop;
- there would be significant costs associated with the construction of a passing lane, procurement of additional locomotive(s) and wagons and upgrades at the Dendrobium CPP;
- although the construction of a passing lane may reduce the hours of operation, it would not reduce the number of train journeys passing any particular location on the line; and
- there would be additional rail noise associated with shunting and wagon bunching when trains enter and exit the passing lane.

Train capacity could also potentially be increased to 2,200 t per train, which could reduce the average number of train movements to eight rail journeys per day. Any increase in train capacity would require an additional locomotive for each train. South32 does not consider this option to be reasonable given that:

- increased train capacities could not occur under current contractual arrangements as there would be significant ongoing contracted costs associated with new wagons and additional locomotives and capital costs associated with upgrades to unloading facilities at the Dendrobium CPP; and
- the additional locomotive on each train would increase passby noise for each train movement (refer to Section 6 for a discussion on the history of rail noise complaints on the Kemira Valley Rail Line).

South32 considers there is no feasible and reasonable alternative that could improve rail efficiency and reduce the currently approved hours of rail operation on the Kemira Valley Rail Line, while still achieving the Project maximum ROM coal production rate.

In consideration of the above, and the significant reduction in the rail noise related complaints, the currently approved hours of operation (6.00 am to 11.00 pm) are proposed to remain unchanged for the Project.

Notwithstanding, South32 would continue to investigate options and implement reasonable and feasible measures to improve rail noise performance over the life of the Project (Section 8).

ROM Coal Transport Dust Mitigation Measures

Site-specific testing of ROM coal from Dendrobium Mine was completed for the Air Quality and Greenhouse Gas Assessment (Appendix I). This testing found that the measured moisture content for ROM coal arriving at the Dendrobium CPP (6.5%) is higher than the measured DEM level (4.6%).

The relatively high moisture content is due to moisture in the coal from mining and coal handling dust suppression activities, the relatively short transportation distance, and low transport speeds.

The installation of covers on wagons used on the Kemira Valley Rail Line would not be feasible or reasonable because:

- site-specific testing indicates fugitive emissions from the coal wagons would be minimal, if present at all, due to the high moisture content of the ROM coal (Appendix I);
- the train loading facilities at Kemira Valley Coal Loading Facility use profile loading, which reduces the potential for lost coal during transport; and
- the use of covers would increase loading times (and overall train cycle times), which would reduce South32's ability to achieve its production targets within the current hours of operation for ROM coal transport.

Gas Management and Abatement

The implementation of gas management and abatement techniques may potentially provide significant safety and efficiency benefits for longwall mining operations during the life of the Project (and if the drained gas is flared there would also be potential for reduction in site greenhouse gas emissions).

Fugitive gas emissions for the Project would result from both mine ventilation air and pre- and post-gas drainage. These fugitive gas emissions would comprise approximately 67% mine ventilation air and approximately 33% pre- and post-gas drainage.

Gas released via pre- and post-gas drainage can potentially be high in methane content, with the remaining typically comprising carbon dioxide gas (Appendix I). However, the gas liberated during mining of Areas 5 and 6 is expected to be highly variable in content and composition.

Gas would be flared or, if the gas is too low in methane content for flaring (or for other operational reasons), vented to the atmosphere (Section 3.5.8). Flares for the Project would operate at the central gas management sites located at the ventilation shafts.

The adoption of flaring as an abatement option would potentially reduce pre- and post-gas drainage emissions by 84% and reduce total fugitive greenhouse gas emissions by 28% (Appendix I).

On the basis of the gas being highly variable in content and composition, South32 has determined that use of the gas for electricity generation would not be feasible for the Project.

Coal Wash Management

Approximately 15.2 Mt of additional coal wash from Areas 5 and 6 would be produced over the life of the Project at the Dendrobium CPP, which would be required to be used, managed or emplaced. In addition, approximately 9.4 Mt of coal wash would be produced from processing coal from remaining areas of the Dendrobium Mine during the life of the Project.

The West Cliff Coal Wash Emplacement already has approved capacity to accommodate the disposal of Project coal wash material, and this capacity would be supplemented by a range of possible beneficial re-use opportunities for the coal wash (e.g. civil construction fill), as is currently occurring for coal wash produced by the approved operations.

As well as current shorter-term supply contracts, South32 has commercial arrangements in place for long-term supply of coal wash for commercial use in the region. In addition to existing arrangements, it is anticipated there will be further demand during the life of the Project for use of coal wash from the Project for other developments.

Final Landform Design of the West Cliff Stage 3 Coal Wash Emplacement

There would be no change to the currently approved final landform design of the West Cliff Stage 3 Coal Wash Emplacement for the Project. The final landform has been designed to be generally consistent with the topography of the surrounding landscape as per the approved *West Cliff Coal Wash Emplacement Area Management Plan* (Illawarra Coal, 2017).

The success of the rehabilitation at the West Cliff Stage 2 Coal Wash Emplacement supports the continued use of the current methodology and rehabilitation practices at the West Cliff Stage 3 Coal Wash Emplacement (Section 7). No change to the final landform design of the West Cliff Stage 3 Coal Wash Emplacement is proposed as a component of the Project.

The operation and rehabilitation of Stage 4 of the West Cliff Coal Wash Emplacement would continue to be undertaken in accordance with Project Approval 08_0150 for the Bulli Seam Operations.

Underground Emplacement of Coal Wash

It is understood the Metropolitan Mine is developing and refining technology to emplace a proportion of coal wash material underground as a component of its ongoing mining operations (Metropolitan Coal, 2018).

Due to the location of the Dendrobium CPP at Port Kembla, the potential underground disposal of Project coal wash is not considered to be a reasonable and feasible solution. Major new infrastructure for loading and unloading coal wash for rail transport would need to be developed, as well as coal wash stockpiling, grinding/processing and pumping systems and underground pipe networks to direct the material underground from Kemira Valley Coal Loading Facility to Dendrobium Mine underground mining areas.

The Dendrobium CPP is, however, well located for transport for alternative beneficial use of coal wash material, such as a construction landfill material. Therefore, this would continue to be the focus of South32's efforts to minimise the transport of coal wash to the West Cliff Coal Wash Emplacement over the life of the Project.

South32 would continue to research and consider alternatives to coal wash emplacement and pursue the ongoing use of coal wash as an engineering fill material over the life of the Project.

Final Land Use

The current revegetation strategy of the Dendrobium Mine considers existing mine closure and rehabilitation objectives and current rehabilitation practices implemented for the Dendrobium Mine and the Cordeaux Colliery.

Mine closure and rehabilitation objectives have been established for underground mining areas and new surface facilities that would be developed for the Project. In general, rehabilitation for the Dendrobium Mine would be developed with the aim that in the long-term, all sites would be rehabilitated to a safe, stable and sustainable landform of a similar character to surrounding areas (Section 7).

In considering the final land use of the Project South32 has adopted an interim final land use of native vegetation for the majority of domains (Section 7).

The final land use to be adopted would be detailed in the Mine Closure Plan for the Project to be prepared approximately 5 years prior to closure. The Mine Closure Plan would be developed in consultation with the Wollongong City Council, Wollondilly and Wingecarribee Shire Councils, the DPE (including the DRG) and the local community. It is anticipated that the measures to be applied to meet the post-mining target uses would be prescribed in the final MOP.

9.2.3 Socio-Economic Impacts

Key feedback received in regard to positive socio-economic benefits of the Project (Appendix K) related to ongoing employment benefits, benefits to local businesses and the ongoing operation of the BlueScope Steelworks.

The Project is considered to facilitate significant ongoing socio-economic benefits in the local and regional areas, given it would:

- Provide for the continuation and extension of the existing Dendrobium Mine workforce by approximately 100 operational personnel.
- Result in additional employment of approximately 200 personnel during the initial surface facility construction and longwall development phases of the Project.
- Provide for the continuation of South32's existing relationships with local suppliers.
- Result in additional expenditure in the local and regional economies during construction and development phases of the Project, noting the capital investment value for the Project is approximately $1 billion.
- Support the ongoing operation of the BlueScope Steelworks by providing an ongoing local supply of metallurgical coal to the BlueScope Steelworks with unique properties "*unable to be replicated to any meaningful extent*" (BlueScope Steel Limited, 2019). The importance of an ongoing supply of coal from the Dendrobium Mine to the viability of the BlueScope Steelworks has been recognised by BlueScope (2019). The significance of the steelmaking industry to the Illawarra region, and the importance of maintaining the steelmaking industry in Australia more generally, is recognised in the Senate Economics References Committee's report *Australia's Steel Industry: Forging Ahead* (Commonwealth of Australia, 2017) (Section 9.1.3).

South32 considers the Project optimises the economically recoverable coal reserves in Project Areas 5 and 6 within CCL 768 to provide the continuation of direct and indirect socio-economic benefits, while minimising potential adverse impacts. Where potentially adverse impacts from the Project cannot be avoided, measures to minimise and offset these potential impacts have been developed (Section 8).

9.3 STATUTORY REQUIREMENTS AND PLANNING/POLICY OBJECTIVES

The following sub-section is a brief synthesis of the key elements of Section 4 and Attachments 6 and 7 of the EIS.

9.3.1 Consideration of the Project against the Objects of the Environmental Planning and Assessment Act, 1979

The SEARs (Section 1.3) require consideration of the consistency of the Project against the objects of the EP&A Act. Section 1.3 of the EP&A Act describes the objects of the EP&A Act as follows:

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

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

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

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

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

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

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

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

(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

(j) to provide increased opportunity for community participation in environmental planning and assessment.

The Project is considered to be generally consistent with the objects of the EP&A Act, as:

- The Project would continue to facilitate local and regional employment and economic development opportunities (Appendix K).
- Illawarra Coal is a local company that has been mining metallurgical coal for steelmaking for over 80 years. The Project would continue to develop the State's mineral resources (i.e. coal resources) and coexist with the local community, as well as with the wider land uses within the region.
- The Project would incorporate relevant ESD considerations (Section 9.3.5).
- Mining operations and nearby land uses, such as state conservation areas and suburban areas have historically co-existed and this would continue for the Project, therefore the Project would not adversely impact, or be inconsistent with, adjoining land uses.
- The Project would incorporate a range of measures for the protection of the environment, including the protection of native plants and animals, threatened species, and their habitats (Section 8).
- The Project includes Aboriginal and historic heritage assessments, which identify suitable management and mitigation measures for potential direct and indirect impacts of the Project (Section 8 and Appendices F and G).
- The Project would largely utilise the existing surface infrastructure of the Dendrobium Mine. However, additional built infrastructure such as ventilation shafts would be coloured to be similar to surrounding vegetation.
- A PHA has been conducted to assess the potential hazards associated with the Project (Section 6 and Appendix N), and existing Occupational Health and Safety (OH&S) measures would continue to be employed for the Project.

- The Project would be determined by the IPC or the Minister, however a wide range of stakeholders have been consulted throughout the assessment process.
- The Project would be developed in a manner that incorporates community engagement through the Project EIS consultation program (Section 5 and Appendix K) as well as the public exhibition of the EIS document and the major project assessment process.

9.3.2 Consideration of the Project against the Objects of the Environment Protection and Biodiversity Conservation Act, 1999

Section 3 of the EPBC Act describes the objects of the EPBC Act as follows:

> *(a) to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and*
>
> *(b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and*
>
> *(c) to promote the conservation of biodiversity; and*
>
> *(ca) to provide for the protection and conservation of heritage; and*
>
> *(d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples; and*
>
> *(e) to assist in the co-operative implementation of Australia's international environmental responsibilities; and*
>
> *(f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and*
>
> *(g) to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.*

The Project is considered to be generally consistent with the objects of the EPBC Act, as:

- The Project incorporates measures to protect the environment (including aspects of the environment that are of national significance), via the Project design (Section 3.5) and the application of mitigation, offsets and other measures (Section 6).
- The Project would continue to develop the State's mineral resources (i.e. coal resources) while incorporating relevant ESD considerations (Section 9.3.5).
- The Project includes Biodiversity and Aquatic Ecology assessments and a proposal for offsetting unavoidable impacts on ecology and other compensatory measures (Sections 6 and 8 and Appendices D and E).
- The Project is not expected to have a significant impact on water resources, on the basis that:
  - reductions in yields in the Special Catchment Areas due to the Project are predicted to be negligible (and South32 would pay WaterNSW for the amount of surface water predicted to be lost to groundwater) (Appendix C);
  - predicted impacts to water quality in the Special Catchment Areas reservoirs and downstream take-off point are predicted to be negligible (and the Project proposes water quality offset measures to account for any small localised water quality impacts resulting from mine subsidence) (Appendix C);
  - 'minimal impact' to groundwater (as defined in the NSW AIP) is predicted (Appendix B);
  - with respect to GDEs, based on monitoring data from previously undermined upland swamps at the Dendrobium Mine (and other mining operations in the Southern Coalfield), changes in upland swamp hydrology as a result of subsidence are not expected to result in significant changes to the extent of upland swamp vegetation and species composition (Appendix D); and
  - significant impacts on aquatic ecology are predicted to be unlikely (Appendix E).
- The Project includes Aboriginal and historic heritage assessments, which identify relevant cultural values (including the significance of biodiversity in Aboriginal cultural values) and suitable management and mitigation measures for potential direct and indirect impacts of the Project (Section 8 and Appendices F and G).

- The Project would be developed in a manner that incorporates engagement from the community, landholders and Indigenous peoples through the Project EIS consultation program (Section 5), the public exhibition of the EIS document and the major Project assessment process.
- The Project includes consideration of South32's contribution to maintaining Australia's international environmental responsibilities and the potential impacts on these (e.g. migratory species protected under international agreements and consideration of greenhouse gas emissions).

9.3.3 Evaluation Under Section 4.15(1) of the Environmental Planning and Assessment Act, 1979

In evaluating the Project Development Application, under section 4.15(1) of the EP&A Act the determining authority is required to take into consideration a range of matters as they are of relevance to the subject of the application, including:

> *(a) the provisions of:*
>
> *(i) any environmental planning instrument, and*
>
> *(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and*
>
> *(iii) any development control plan, and*
>
> *(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and*
>
> *(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),*
>
> *…*
>
> *that apply to the land to which the development application relates,*
>
> *(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,*
>
> *(c) the suitability of the site for the development,*
>
> *…*
>
> *(e) the public interest.*

While this is a requirement of the determining authority, this EIS has been prepared to generally address the requirements of section 4.15(1) to assist the Minister or the IPC in evaluating the Project, as follows:

- Consideration of the requirements of relevant environmental planning instruments, development control plans and the EP&A Regulation is provided in Sections 1 and 4 and Attachments 6 and 7 of the EIS.
- While no planning agreement or draft planning agreement has been developed for the Project to date, consideration of the proposed ongoing community contributions of the Dendrobium Mine is provided in Section 4.3.8.
- The predicted impacts of the Project, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality are provided in Appendices A to P and Section 6 of the EIS.
- The suitability of the proposed site for the Project is considered in Section 4 and this Section of the EIS.
- Consideration of whether, on evaluation, the Project is considered to be in the public interest is provided in Section 9.5.

9.3.4 Potential Implications of Climate Change

Consideration of the potential implications of climate change involves complex interactions between climatic, biophysical, social, economic, institutional and technological processes.

Although understanding of climate change has improved markedly over the past several decades, climate change projections are still subject to uncertainties such as (CSIRO, 2015):

- *scenario uncertainty, due to the uncertain future emissions and concentrations of greenhouse gases and aerosols;*
- *response uncertainty, resulting from limitations in our understanding of the climate system and its representation in climate models; and*
- *natural variability uncertainty, the uncertainty stemming from unperturbed variability in the climate system*

Climate Change Projections in Australia

In Australia, the climate is projected to become warmer and drier.

Climate change may result in changes to rainfall patterns, runoff patterns and river flow. High scenario projections for annual average rainfall changes in 'Eastern Australia' for 2030 and 2090, relative to the 1986-2005 baseline are presented in Table 9-1.

Table 9-1
Climate Change Projections for East Coast South sub-cluster, Eastern Australia – Percentage Change in Rainfall

Period	2030	2090	
	RCP4.5	RCP4.5	RCP8.5
Summer	+1%	0%	+11%
Autumn	-3%	-1%	-2%
Winter	-5%	-8%	-17%
Spring	-1%	-6%	-8%
Annual	-3%	-2%	-3%

Source: CSIRO (2015)

RCP4.5: Emissions scenario assuming a slow reduction in emissions that stabilises CO_2 concentration at about 540 ppm parts per million (ppm) by 2100.

RCP8.5: Emissions scenario assuming an increase in emissions leading to a CO_2 concentration of about 940 ppm by 2100.

Climate Change Projections in NSW

The Project is located within the Illawarra, Metropolitan Sydney and South East and Tablelands Regions of the NARCliM Project domain.

Mean temperatures within these regions are projected to rise on average by up to approximately 0.7°C by 2030 and 2°C by 2070. These temperature increases are occurring across the region, with the greatest temperature increase during summer (NARCliM, 2015).

NARCLiM (2015) modelling suggests annual rainfall is predicted to vary across the respective regions (Table 9-2).

The NARCliM (2015) and CSIRO (2015) rainfall projections are quite variable, particularly for the 2060-2079 and 2090 forecasts, respectively. As shown in Table 9-1, CSIRO (2015) is projecting a drier climate, whereas Table 9-2 indicates that NARCliM (2015) is projecting a generally wetter climate.

The potential implications of climate change on local groundwater and surface water resources are considered in Appendices B and C, respectively.

The potential contributions of Project greenhouse gas emissions to national and international emissions are considered in the following sub-sections.

9.3.5 Ecologically Sustainable Development Considerations

Background

The concept of sustainable development came to prominence at the World Commission on Environment and Development (1987), in the report titled *Our Common Future*, which defined sustainable development as:

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

Table 9-2
Climate Change Projections for the Illawarra, Metropolitan Sydney and South East and Tablelands Regions – Percentage Change in Rainfall

Period	Illawarra Region		Metropolitan Sydney Region		South East and Tablelands Region	
	2020-2039	2060-2079	2020-2039	2060-2079	2020-2039	2060-2079
Summer	+1.5%	+10.9%	-0.2%	+12.3%	+0.8%	+8.8%
Autumn	+5.6%	+15.1%	+9.7%	+13.6%	+6.5%	+11.0%
Winter	-4.9%	-6.6%	+0.0%	-0.1%	-2.6%	-4.1%
Spring	-1.5%	-1.3%	-2.6%	+3.1%	-7.5%	-11.2%
Annual	-0.4%	+6.5%	+1.7%	+8.9%	-1.8%	+1.4%

Source: NARCliM (2015)

In recognition of the importance of sustainable development, the Commonwealth Government developed a National Strategy for Ecologically Sustainable Development (NSESD) (Commonwealth of Australia, 1992) that defines ESD as:

> *using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.*

The NSESD was developed with the following core objectives:

- *to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;*
- *to provide for equity within and between generations; and*
- *to protect biological diversity and maintain essential processes and life support systems.*

Australia's commitment to the principles of ESD is considered in the EPBC Act, which defines the principles of ESD as:

> *(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;*
>
> *(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*
>
> *(c) the principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;*
>
> *(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;*
>
> *(e) improved valuation, pricing and incentive mechanisms should be promoted.*

For the purposes of this EIS, the relevant definition of ESD is that found in section 6(2) of the NSW *Protection of the Environment Administration Act, 1991*, which is the definition adopted by the EP&A Act. This definition provides as follows:

> *Ecologically sustainable development requires the effective integration of social, economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:*
>
> *(a) the precautionary principle – namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*
>
> *In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options.*
>
> *(b) inter-generational equity – namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*
>
> *(c) conservation of biological diversity and ecological integrity – namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*
>
> *(d) improved valuation, pricing and incentive mechanisms – namely, that environmental factors should be included in the valuation of assets and services, such as:*
>
> *(i) polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
>
> *(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

Consideration of Ecologically Sustainable Development for the Project

Project design, planning and assessment have been carried out applying the principles of ESD, through:

- incorporation of risk assessment and analysis at various stages in the Project design and environmental assessment and within decision-making processes;
- adoption of high standards for environmental and occupational health and safety performance;

- consultation with regulatory and community stakeholders; and
- optimisation of the potential economic benefits to the community arising from the development of the Project.

Assessment of potential medium and long-term impacts of the Project was carried out during the preparation of this EIS on aspects of surface water and groundwater, transport movements, air quality emissions (including greenhouse gas emissions), noise emissions, aquatic and terrestrial ecology, heritage and socio-economics.

The Project design takes into account biophysical considerations, including the principles of ESD as defined in section 6(2) of the *Protection of the Environment Administration Act, 1991*.

In addition, it can be demonstrated that the Project can be operated in accordance with ESD principles through the application of mitigation measures, compensatory measures and offset measures that have been developed based on conservative impact assumptions for the Project.

The following sub-sections describe the consideration and application of the principles of ESD to the Project.

Precautionary Principle

Environmental assessment involves predicting the likely environmental outcomes of a development. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

An ERA (Appendix M) and PHA (Appendix N) were conducted to identify Project related risks and develop appropriate mitigation measures and strategies.

The PHA considers off-site risks to people, property and the environment (in the presence of controls) arising from atypical and abnormal hazardous events and conditions (i.e. equipment failure, operator error and external events).

The ERA addressed potential environmental impacts associated with the Project, including long-term effects. In addition, potential long-term risks are considered by the specialist studies conducted in support of this EIS (Section 1.4).

In the Groundwater, Surface Water and Economic Assessments (Appendices B, C and L), risk and uncertainty have also been taken into account through sensitivity and/or uncertainty analysis.

Findings of these specialist assessments are presented in Section 6 and relevant appendices. Measures designed to mitigate potential environmental impacts arising from the Project are also described in Section 6, and summarised in Section 8.

The specialist assessments, PHA and ERA have evaluated the potential for harm to the environment associated with the development of the Project. A range of mitigation measures have been adopted as components of the Project design to minimise the potential for serious and/or irreversible damage to the environment, including the development of environmental management and monitoring programs, compensatory measures and ecological offsets based on conservative assumptions (Section 8). Where residual risks are identified, contingency controls have been considered (Section 8).

In addition, for key Project environmental assessment studies (i.e. Groundwater Assessment [Appendix B] and Surface Water Assessment [Appendix C]), peer review by recognised experts was undertaken (Attachment 5).

South32 would undertake geological investigations such as in-seam drilling as a component of the ongoing mining operation to identify geological features that may be of relevance to the refinement of Project subsidence predictions and/or mine design to maintain environmental performance consistent with the Project as approved. These investigations would help to manage the risk of unexpected outcomes in regard to potential surface water and/or groundwater impacts, associated potential impacts to water-dependent ecology and potential impacts on water harvesting infrastructure, and therefore, increase the level of certainty that predictions of environmental impacts would not be exceeded.

The approach with respect to the management of subsidence effects on surface features (such as infrastructure and cliffs) within the extent of the proposed mining areas, which provides for the implementation of additional response and contingency measures in the event that the impacts being observed exceed approved thresholds, also provides increased certainty that the environmental outcomes predicted in this EIS would be achieved (Section 6).

Social Equity

Social equity is defined by inter-generational and intra-generational equity. Inter-generational equity is the concept that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations, while intra-generational equity is applied within the same generation.

The principles of social equity are addressed through:

- assessment of the social and economic impacts of the Project (Appendices K and L, and Section 6), including the distribution of impacts between stakeholders and consideration of the potential social and economic costs of climate change;
- management measures to be implemented in relation to the potential impacts of the Project on water resources, heritage, land resources, noise, air quality, ecology, transport, hazards and risks, greenhouse gas emissions and socio-economics (Section 8);
- implementation of environmental management and monitoring programs (Section 8) to minimise potential environmental impacts (which include environmental management and monitoring programs covering the Project life); and
- implementation of measures during the life of the Project to offset potential localised impacts that have been identified for the development (Section 8).

The Project would benefit current and future generations through the maintenance and expansion of Dendrobium Mine employment (up to an additional 200 people during Project construction and employment to some 500 operational staff during peak Project operations). Flow-on employment effects in the region would also be significant (Appendix K).

Economic benefits potentially forgone if the Project does not proceed amounts to a net benefit of $1,073 million in NPV terms to the State of NSW and $431 million in NPV terms to the greater Wollongong Region (Appendix L). This includes an estimated $272.1 million in royalties, payroll tax and council values in NPV terms.

The Project incorporates a range of mitigation measures to minimise potential impacts on the environment and the costs of these measures would be met by South32 and these costs have been included in the economic assessment (Appendix L). The potential benefits to current and future generations have therefore been calculated in the context of the mitigated Project.

Project benefits would also flow to sectors like steel manufacturing which use metallurgical coal as key inputs to the manufacturing process.

Various mines in the Illawarra region, including the Dendrobium Mine, supply coal to the BlueScope Steelworks at Port Kembla. Any disruption of supply to the BlueScope Steelworks may adversely affect the economic benefits of this facility, through impacts on operational costs, output and employment.

Conservation of Biological Diversity and Ecological Integrity

Biological diversity or ‘biodiversity’ is considered to be the number, relative abundance, and genetic diversity of organisms from all habitats (including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part) and includes diversity within species and between species as well as diversity of ecosystems (Lindenmayer and Burgman, 2005).

For the purposes of this EIS, ecological integrity has been considered in terms of ecological health and ecological values.

The Project Development Application Area includes extensive areas with recognised ecological values, which include the presence of threatened flora and fauna species as well as TECs (Section 6). The environmental assessments in Sections 6.7 to 6.9 (and Appendices D and E) describe the potential impacts of the Project on the biological and ecological environment and associated Project mitigation and offset measures.

Greenhouse Gas Emissions and Biological Diversity and Ecological Integrity

The Dendrobium Mine is an existing contributor to NSW and Australian greenhouse gas emissions, and this would continue to be the case for the Project (Appendix I and Section 6).

Many natural ecosystems are considered to be vulnerable to climate change. Patterns of temperature and precipitation are key factors affecting the distribution and abundance of species (Preston and Jones, 2005). Projected changes in climate will have diverse ecological implications. Habitat for some species will expand, contract and/or shift with the changing climate, resulting in habitat losses or gains, which could prove challenging, particularly for species that are threatened.

Human-caused climate change is listed as a key threatening process under the BC Act and Loss of Climatic Habitat Caused by Anthropogenic Emissions of Greenhouse Gases is listed as a key threatening process under the EPBC Act.

It is acknowledged that (subject to the efficacy of national and international greenhouse gas abatement measures) all sources of greenhouse gas emissions in NSW, irrespective of their scale, will contribute in some way towards the potential global, national, state and regional effects of climate change.

The Project's contribution to global climate change would be proportional to its contribution to global greenhouse gas emissions.

At the Conference of Parties 21 (in 2015), parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached an agreement to combat climate change at a global level (the Paris Agreement). The goal of the Paris Agreement is to limit global temperature increases to well below 2°C (UNFCCC, 2019).

This is to be achieved by reaching peak global emissions as soon as possible, so as to achieve a "*balance between anthropogenic emissions by sources and removals by sinks of GHGs* [greenhouse gases] *in the second half of the century*" (UNFCCC, 2019).

The Paris Agreement does not specify how global emission reductions are to be achieved. It requires countries that are parties to the Paris Agreement to prepare, communicate and maintain nationally determined contributions (NDCs) and to pursue domestic measures to achieve them (UNFCCC, 2019). The NDCs are to be communicated every 5 years, with each successive NDC to represent a progression beyond the previous NDC.

Australia's existing NDC is a greenhouse gas emission reduction target of 26 to 28% on 2005 levels by 2030 (Commonwealth of Australia, 2015).

Measures to reduce the Project's direct (Scope 1) greenhouse gas emissions are described in Section 8. However, over 90% of the Project's total Scope 1, 2 and 3 emissions are associated with the end use of the product coal by customer organisations (i.e. primarily for steelmaking). A portion of these Scope 3 emissions at customer's facilities would occur in Australia, for example when the coal is used at the BlueScope Steelworks or Whyalla Steelworks.

The Project is a continuation of mining at the Dendrobium Mine (which was approved in 2001 and is approved to operate until 2030), using the same longwall mining method. No increase in maximum annual ROM coal production is proposed for the Project. The existing emissions associated with the end-of-use coal from the Dendrobium Mine are already reflected in Australia's greenhouse gas accounting. The Project would, however, facilitate continuation of the existing emissions from these Australian facilities.

The majority of greenhouse gas emissions produced from the blast furnace method of steel manufacture, as is employed at the BlueScope Steelworks, are a direct result of the chemical process that uses carbon (from coal) to extract iron from iron ore (BlueScope Steel Limited, 2008). The remaining GHG emissions at Port Kembla are indirect, largely from purchased electricity (e.g. produced by combusting thermal coal) (BlueScope Steel Limited, 2008).

Project coal would be used as a reducing agent in the BlueScope Steelworks blast furnace. It is understood there are currently no commercial-scale alternatives to metallurgical coal as a reducing agent in the blast furnace method. Assuming BlueScope Steelworks continues to require metallurgical coal in its blast furnace, then if the Project was not approved there would be:

- No net change in Australia's greenhouse gas emissions due to the end use of coal, assuming BlueScope Steelworks sourced coal from alternative sources. However, as noted by the ACCC (2017), the Illawarra region is not expected to have producers capable of supplying volumes of technically substitutable metallurgical coals (to those produced by South32 and the Metropolitan Mine) in the medium to long term, and if coal was sourced from the Bowen Basin this would come at a cost of an additional $US10-15 per tonne of coal to BlueScope.

- A decrease in Australia's greenhouse gas emissions if steelmaking is reduced as a result of not sourcing an alternative coal supply. This would result in associated reductions in the safety and socio-economic benefits of local steelmaking recognised by the Senate Economics Reference Committee (Commonwealth of Australia, 2017), and unless there was a corresponding reduction in the demand and use of steel from 'virgin' iron, no net reduction in global greenhouse gas emissions.

Where coal from the Project is used overseas, emissions associated with the end use of this coal would be managed by any NDCs of these countries.

In addition, South32's Company-wide Climate Change Strategy reflects key strategies of the Paris Agreement, as it includes:

- The target of staying below a baseline Scope 1 greenhouse gas emissions level (established based on financial year 2015) until 2021 (i.e. company-wide peak emissions would be reached between 2015 and 2021).
- Reviewing and reducing greenhouse gas emissions every five years from 2021 to achieve a goal of net zero Scope 1 greenhouse gas emissions by 2050 (including carbon offsetting for any residual emissions).

Measures to Maintain or Improve the Biodiversity Values of the Surrounding Region

A range of measures would be implemented for the Project to maintain or improve biodiversity values of the region in the medium to long term. As summarised below and detailed in Sections 6.7 to 6.9, these measures include impact avoidance, minimisation, mitigation and offsets (for residual impacts).

South32 has well established and accepted management practices for operating an underground coal mine in the same environment as the Project proposes. These include minimising access and disturbance (i.e. through implementation of a vegetation clearance protocol), measures to limit the risk of spreading weeds and other pests, measures to reduce the risk of bushfires from surface facilities (e.g. enclosed flaring of gas), speed limits to reduce vehicle strike, measures to limit noise and lighting impacts to fauna etc.

The design and location of surface facilities required for the Project have been through a design process to avoid and/or reduce impacts to biodiversity values. This includes avoidance (as far as practicable) of TECs and threatened fauna habitat, as well as minimisation of disturbance footprint and re-design of the infrastructure layout to avoid threatened flora and fauna values. Upland swamp communities have been avoided for all Project related surface facilities and their supporting infrastructure (e.g. power supply and access tracks).

South32 has continued its existing company-wide avoidance commitments relating to longwall designs and natural features. These include various commitments relating to biodiversity (among others, more detail is provided in Section 3.5) such as setbacks from named watercourses, restricting extraction heights, no mining beneath drinking water supply reservoirs and setbacks from key stream features (e.g. select pools and waterfalls).

The Project also includes the relinquishment of existing authority to impact an area of upland swamp vegetation in Area 3, thereby reducing and avoiding impacts previously approved.

Residual impacts of the Project to biodiversity are also provided for by a biodiversity offset. All residual impacts have been conservatively assessed and an offset strategy is proposed as part of the Project to maintain or improve biodiversity value of the region in the medium to long term.

Further detail on the management of potential biodiversity impacts is provided in Sections 6.7 to 6.9.

Valuation

One of the common broad underlying goals or concepts of sustainability is economic efficiency, including improved valuation of the environment. Resources should be carefully managed to maximise the welfare of society, both now and for future generations.

In the past, some natural resources have been misconstrued as being free or underpriced, leading to their wasteful use and consequent degradation. Consideration of economic efficiency, with improved valuation of the environment, aims to overcome the underpricing of natural resources and has the effect of integrating economic and environmental considerations in decision making, as required by ESD.

While environmental costs have been considered to be external to Project development costs historically, improved valuation and pricing methods attempt to internalise environmental costs and include them within Project costing.

The Economic Assessment (Appendix L) has incorporated environmental values via direct valuation where practicable (e.g. greenhouse gas emissions of the Project). Furthermore, wherever possible, direct environmental effects of the Project would be internalised through the adoption and funding of mitigation measures by South32 to mitigate potential environmental impacts (e.g. biodiversity offset costs, infrastructure management costs).

Greenhouse gases directly generated by the Project (i.e. Scope 1 emissions) on average are estimated to be approximately 768,469 t CO_2-e per year or 592,553 t CO_2-e per year, depending on whether pre- and post-gas drainage is vented or flared, respectively (Appendix I). Indirect emissions associated with the on-site use of fuel and electricity (i.e. Scope 2 emissions) are estimated on average to be 57,023 t CO_2-e per year (Appendix I).

The Economic Assessment in Appendix L indicates a net benefit (i.e. net of the value of externalities including Scope 1 and 2 greenhouse gas emissions) of $1,073 million in NPV terms to the State of NSW and $431 million in NPV terms to the greater Wollongong Region would be forgone if the Project is not implemented. This includes an estimated $272.1 million in royalties, payroll tax and council values in NPV terms.

While the value of externalities from indirect (Scope 3) greenhouse gas emissions are not considered in the net benefit to NSW, neither are the economic benefits associated with the ongoing use of this coal for steelmaking and other uses, which have been recognised as significant to the Illawarra region and Australia (Commonwealth of Australia, 2017).

Notwithstanding, Scope 3 greenhouse gas emissions that may be emitted by other parties, namely from the use of the product coal produced by the Project are considered in this EIS. On average, over the life of Project, the indirect (i.e. Scope 3) emissions from these activities are estimated to be approximately 8 Mt CO_2-e per year (Appendix I), with a proportion of these global Scope 3 emissions occurring directly in NSW (e.g. BlueScope Steelworks) and Australia (e.g. Liberty Primary Steel Whyalla Steelworks).

These (typically manufacturing related) greenhouse gas emissions are currently occurring at facilities such as the BlueScope Steelworks and are therefore already accounted for in NSW and Australia's current greenhouse gas emission estimates. These emissions, therefore, form part of the existing Australian greenhouse gas emission estimates that are being considered by State and Federal Governments when developing greenhouse gas abatement mechanisms to meet Australia's international greenhouse gas abatement obligations (e.g. under the Paris Agreement).

9.3.6 Neutral or Beneficial Effect on Water Quality

Clause 10 of the Sydney Drinking Water Catchment SEPP requires the consent authority (i.e. the IPC or the Minister) to be satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality (i.e. the NorBE Test).

Clause 11A of the Sydney Drinking Water Catchment SEPP also relevantly provides:

> …
>
> *the carrying out of the proposed development will have a neutral or beneficial effect on water quality if it will have the same or a lesser adverse impact on water quality when compared to the adverse impact that the continuing development would have if it were extended or expanded under similar conditions as the existing development consent.*
>
> *…*

The NorBE on Water Quality Assessment Guideline (Sydney Catchment Authority [SCA], 2015) states:

> *The NorBE test is not an exact science. The SCA's approach to decide a neutral or beneficial effect will be a mixture of:*
>
> - *using various guidelines, standards and practices to show that NorBE is satisfied*
> - *quantitative neutral or beneficial effect evaluation or assessment using the WEM and/or the S3QM / MUSIC stormwater models*
> - *assessment of water quality risks*
> - *qualitative assessment of internal offsets to ensure a neutral or beneficial effect.*

Guidelines and Standards

The Surface Water Assessment (HEC, 2019) has been prepared in consideration of WaterNSW's current recommended practices and standards.

Sediment controls at the new ventilation shaft sites to be located in the Metropolitan Special Area have been designed consistent with *Managing Urban Stormwater Soils and Construction – Volume 2E – Mines and Quarries* (DECC, 2008).

Quantitative Evaluation

The effectiveness of these controls have been quantitatively assessed using the *Model for Urban Stormwater Improvement Conceptualisation* (MUSIC) to confirm there would be a neutral impact on water quality at Pheasants Nest Weir from runoff from the proposed ventilation shafts (noting this proposed surface infrastructure is not in catchments reporting to the Avon or Cordeaux Dams) (Appendix C).

Assessment of Water Quality Risks

In regard to potential subsidence impacts, HEC (2019) describes subsidence could result in localised, episodic pulses in iron, manganese and electrical conductivity, as has been observed as a result of previous longwall mining. However, when considering the potential end use of surface water in the Special Catchment Areas is drinking water supply, these potential localised effects are considered to be environmentally neutral given that (HEC, 2019):

- similar pulses occur naturally in the areas of the Special Catchment Areas that are outside the influence of historic mining (HEC, 2019); and
- there has been no measurable effect on water quality in the reservoirs in the Special Catchment Areas as a result of subsidence to date (HEC, 2019).

This is supported by analysis from Professor Chris Fell AM in the discussion paper for the Office of the NSW Chief Scientist and Engineer (Fell, 2014), which stated:

> *Although the impact of underground long-wall mining in the catchment could lead to small changes in the levels of impurities in water entering SCA's dams, these changes can be coped with by SW's treatment plants as evidence to date does not suggest a sufficiently large change in soluble organic concentrations to be of concern.*

Fell (2014) also identifies parameters of importance with respect to drinking water supply. The water quality parameters that may be potentially impacted by Project-related subsidence are not parameters of importance identified by Fell (2014) (HEC, 2019).

Qualitative Assessment of Internal Offsets

Following review of risks to water quality, the Sydney Catchment Authority (now part of WaterNSW) identified suspended solids as a priority area for risk management (Fell, 2014).

The *Special Areas Strategic Plan of Management 2015* (WaterNSW and OEH, 2015) describes land management programs to control sedimentation in the Special Catchment Areas as a priority under the Plan.

South32 therefore proposes water quality improvement actions as part of the Project to target reduced sedimentation in the Special Catchment Areas. These Project actions would be additional to those already proposed and funded by WaterNSW as part of the *Special Areas Strategic Plan of Management 2015* and include:

1. Transfer of 28.5 ha of South32-owned land within the Metropolitan Special Area to WaterNSW.

   This would enable WaterNSW to manage and protect this land in accordance with the *Special Areas Strategic Plan of Management 2015*, which does not cover privately-owned land in the Special Catchment Areas.

   For example, access restrictions could be imposed on land transferred from South32 to WaterNSW, as access restrictions do not apply to privately-owned land in the Special Catchment Areas (WaterNSW and OEH, 2015).

2. Direct implementation (by South32) or funding (to WaterNSW) of water quality improvement works within the Special Catchment Areas (Table 9-3).

   WaterNSW's *Catchment Protection Work Program 2018-19: Sydney Catchment Area* outlines planned activities for water quality management in the Sydney Catchment Area, as well as the planned benefits for these activities.

   The additional works proposed for the Project would complement those planned by WaterNSW as outlined in Table 9-3.

Table 9-3
Water Quality Improvement Works

Water Quality Improvement Work	Estimated Financial Contribution (if works not conducted by South32)
Fire Management: • Slashing grass and vegetation for fire breaks (100 km and 200 ha). • Mulching trees and woodland along fire trails to maintain fire breaks (at least 22.5 km). • Conducting hazard reduction burns (at least 100 ha) in consultation with relevant authorities.	$371,500[1]
Inspect and Maintain Unsealed Road Network: • Inspect 150 km of unsealed roads. • Repair and upgrade 40 km of unsealed roads within the Special Catchment Areas.	$146,000[1]
Install and Maintain Appropriate Barriers and Fences: • Install barriers as required around any land transferred to WaterNSW. • Install barriers and fences to replace those that are damaged or vandalised.	$100,000[2]
Total	**$617,500**

1 Based on conducting an additional 50% of WaterNSW's Planned Activities for Fire Management and Unsealed Roads Program as per the *Catchment Protection Work Program 2018-19: Sydney Catchment Area*.

2 Estimation only.

Assessment Against the NorBE Test

It is considered the Project would have a beneficial effect on water quality in the Special Catchment Areas given that:

- Sediment controls for additional surface infrastructure would be designed and operated in accordance with WaterNSW guidelines and standards, and quantitative evaluation of potential water quality impacts using MUSIC predicts there would be a neutral impact on water quality.
- Localised and episodic potential impacts on water quality due to Project-related subsidence are expected to be environmentally neutral, considering the lack of evidence of adverse effects on drinking water supplies to date.
- The Project proposes water quality improvement actions to offset the potential localised water quality impacts associated with subsidence. These actions target a priority water quality risk area identified by WaterNSW, namely sediment control, and would result in material improvements to water quality within the Special Catchment Areas as they are consistent with WaterNSW's planned management works.

9.3.7 Other Policies and Strategic Objectives

Other policies and strategic objectives are described in Section 4 and Attachments 6 and 7. The Project is generally consistent with applicable relevant policies and strategic objectives.

9.4 EVALUATION OF KEY IMPACTS AND BENEFITS

9.4.1 Key Potential Impacts

Regulatory and public engagement by South32 for the Project (Section 5) has identified a number of key assessment issues for the Project. Key potential Project direct impacts and indirect adverse impacts are described below.

Potential Adverse Direct Impacts

Potential adverse direct impacts can be generally grouped into:

- impacts related to Project underground mining subsidence;
- associated impacts on the overlying physical environment; and
- impacts of the surface activities of the Dendrobium Mine that are not related to mine subsidence.

Tables 9-4 to 9-6 summarise key direct impacts, South32's proposed mitigation measures to address these impacts, and the associated Project outcomes associated with:

- mine subsidence effects on water supply;
- biodiversity and Aboriginal heritage values; and
- amenity effects from the continued operation of the Dendrobium Mine surface facilities.

Potential Adverse Indirect Impacts

Most potential indirect impacts of the Project identified in Project engagement have been positive in nature (e.g. indirect employment effects, supplier benefits, the significance of local metallurgical coal supply to the ongoing operation of BlueScope Steelworks).

However, an indirect adverse impact of the Project arising in some engagement has been the potential for Scope 1 and Scope 2 greenhouse gas emissions of the Project, and Scope 3 greenhouse gas emissions (i.e. customer greenhouse gas emissions from the burning of Project product coal) to contribute to global climate change effects (Section 9.3.4).

Table 9-7 summarises the potential impacts of greenhouse gas emissions from the production and burning of Project product coal, South32's proposed mitigation measures to address these impacts, and the associated Project outcome.

9.4.2 Key Potential Benefits

The Project provides for the continuation and extension of underground mining and processing activities at the Dendrobium Mine to 2048 as described in Sections 2 and 3.

The continued development of coal resources in close proximity to Illawarra Coal's existing infrastructure and other supporting facilities maximises the use of these established facilities and associated returns on existing financial investment.

Longwalls within the approved Area 3C mining domain (beyond proposed Longwalls 20 and 21) would be mined during the life of the Project, between Areas 5 and 6 (Section 3).

The yet to be mined Area 3C accounts for a total of 16.1 Mt of ROM coal. For Area 3C to be mined, significant gas drainage works would be required, and in the absence of the Project, there would be a discontinuity of mining at the Dendrobium Mine following the completion of mining in Area 3B and Longwalls 20 and 21. This would adversely affect the economic viability of the remainder of Area 3C (Section 3), resulting in reduced employment numbers during any such discontinuity and have flow-on implications for BlueScope Steel, the Port Kembla Coal Terminal, the Bulli Seam Operations and local suppliers to the Dendrobium Mine.

The Project would involve the production of up to approximately 5.2 Mtpa of ROM coal, with approximately 78 Mt of additional ROM coal extracted over the life of the Project in comparison to the approved Dendrobium Mine.

The Project would include the implementation of environmental mitigation measures (including performance monitoring and adaptive management) to minimise potential impacts on the environment and community (Section 6).

A summary of the Project environmental mitigation, monitoring and reporting measures are provided in Section 8.

Socio-Economic Benefits

The Project would increase the availability and longevity of employment at the Dendrobium Mine.

At full development, the Project operational workforce would be in the order of 500 full-time equivalent on-site personnel inclusive of both direct South32 employment and on-site contractor employees. The Project, therefore, would include an increase of approximately 100 operational personnel from the current workforce of the Dendrobium Mine.

An additional construction workforce of up to approximately 200 people would also be required during the initial Project surface facility construction and longwall development phase. Construction activities would, however, be undertaken at various times over the life of the Project, with smaller construction workforce peaks associated with other activities as required.

Table 9-4
Key Potential Impacts and Associated Project Outcomes – Water Supply

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures	Project Outcome Summary
Reduced water yield from drinking water catchments.		
Due to connective fracturing and associated groundwater depressurisation, a proportion of surface water flows from streams overlying the mine would report to deeper groundwater systems, and ultimately into the Project water management system. This has been estimated to be less than 1% of the Avon and Cordeaux catchment yields (Section 6).	South32 already holds WALs for the groundwater take of the Project from the deeper groundwater systems, including the volume that may report to groundwater systems from surface water systems. South32 would also pay WaterNSW for the volume of surface water diverted from the Drinking Water Catchment (i.e. as it would be no longer available for sale to other water users). Further, South32 would seek to divert a proportion of Project excess mine water to beneficial re-use at the Port Kembla industrial precinct. Where this replaces industrial water sourced from WaterNSW, this would obviate any potential minor impact on the WaterNSW total water budget.	WaterNSW would be no worse off financially due to potential Project impacts on drinking water catchment yield. South32 would pursue opportunities for industrial re-use of mine water such that the re-use volume matches or exceeds predicted Project surface water take, achieving no net reduction in the total WaterNSW water budget (Section 6).
Potential impacts on water quality in drinking water catchments.		
The *Special Areas Strategic Plan of Management 2015* (WaterNSW and OEH, 2015) describes land management programs to control sedimentation in the Special Catchment Areas as a priority under the Plan. Additional Project surface disturbance activities within the drinking water catchments may lead to sediment generation. Mine subsidence could result in localised, episodic pulses in iron, manganese and electrical conductivity in surface water systems, as has been observed as a result of previous longwall mining.	Project sediment controls for surface disturbance activities would be designed consistent with *Managing Urban Stormwater Soils and Construction – Volume 2E – Mines and Quarries* (DECC, 2008). While there has been no measurable effect on water quality in Special Catchment Areas reservoirs as a result of localised, episodic pulses in iron, manganese and electrical conductivity from longwall mining in the past, South32 proposes water quality improvement actions such as fire management and maintenance of unsealed roads as part of the Project. These actions for the Project would be additional to those already proposed and funded by WaterNSW and would target reduced sedimentation in the Special Catchment Areas. This would result in material improvements to water quality within the Special Catchment Areas, as the measures are consistent with WaterNSW's planned management works.	It is considered the Project would have a net beneficial effect on water quality in the Special Catchment Areas (Section 6).
Potential subsidence impacts on water supply infrastructure.		
Mine subsidence can adversely impact surface infrastructure, including water supply infrastructure maintained by WaterNSW.	The longwall layout proposed for the Project (Section 3) has been designed by South32 to reflect adoption of a number of longwall mine constraints to minimise potential impacts, including 1km setbacks from the existing Avon and Cordeaux Dam walls and a minimum 300 m longwall setback from the existing dam FSLs. Approval from the NSW DSC would be required for any Project mining within DSC Notification Areas associated with the existing Avon and Cordeaux Dams.	No material subsidence impacts on existing WaterNSW water supply infrastructure are predicted to arise due to the Project (Section 6).

Table 9-5
Key Potential Impacts and Associated Project Outcomes – Biodiversity and Aboriginal Heritage Values

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures	Project Outcome Summary
Potential impacts on upland swamp drying and wetting cycles.		
Project mine subsidence may result in changes to upland swamp hydrology for upland swamps within 60 m of the longwalls (i.e. longer dry periods due to an increased rate of water level recession following rainfall). Upland swamps include EECs and provide habitat for threatened fauna species.	The Swamp Offset Policy (OEH, 2016a) provides the framework for offsetting residual impacts to swamps from longwall mining. Many upland swamps overlying Areas 5 and 6 currently experience natural drying and wetting cycles (Appendix D). Based on monitoring data from previously undermined upland swamps at the Dendrobium Mine (and other mining operations in the Southern Coalfield), changes in swamp hydrology as a result of subsidence are not expected to result in significant changes to the extent of upland swamp vegetation and species composition (Appendix D). Notwithstanding, predicted impacts to upland swamps due to the Project subsidence would be offset via the Project biodiversity offset strategy (Section 6). South32 would offset potential subsidence impacts to TECs associated with upland swamps, as well as offsets for threatened fauna species for which the upland swamps provide habitat (Section 6).	Potential Project subsidence impacts on upland swamps and associated potential habitat effects would be offset consistent with NSW and Commonwealth Government policies.
Potential impacts on riparian and aquatic values due to alteration of surface water flows.		
Project mine subsidence may result in changes to stream hydrology overlying the longwalls (e.g. recession of pools following rainfall) with potential impacts on aquatic ecology habitat values and associated threatened fauna species.	South32 has adopted longwall setbacks from named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek) to achieve 200 mm or less of predicted additional Project subsidence-related closure. The Project also includes avoiding the direct undermining of mapped 'key stream features' overlying the Project underground mining Areas 5 and 6. Significant Project impacts on aquatic ecology are predicted to be unlikely (Appendix E). Notwithstanding, impacts on biodiversity in all streams directly overlying the Project longwalls and immediately downstream would be offset in accordance with the FBA based on the conservative assumption that all sections of stream are adversely impacted, irrespective of proposed mining setbacks and constraints (Sections 3 and 6).	Potential Project subsidence impacts on aquatic ecology values and associated potential habitat effects would be offset consistent with NSW and Commonwealth Government policies.
Potential impacts of direct land disturbance on biodiversity and heritage values.		
Project surface development works within the Drinking Water Catchments may impact on the largely undisturbed biodiversity values and Aboriginal heritage values associated with these protected areas.	Additional Project surface infrastructure has been preferentially sited in close proximity to existing fire trails to minimise land disturbance, and designed to particularly minimise potential disturbance of mapped Shale Sandstone Transition Forest of the Sydney Basin Bioregion CEEC and upland swamps (Appendix D and Section 6). Notwithstanding, predicted impacts on biodiversity from surface disturbance activities would be offset in accordance with the FBA. Proposed surface infrastructure for the Project has been designed to avoid all known sandstone shelters, axe grinding grooves and natural landscape features and South32 would avoid disturbance of known Aboriginal heritage sites where practicable.	Potential Project surface disturbance impacts on biodiversity would be offset consistent with NSW and Commonwealth Government policies. An AHMP would be developed for the Project in consultation with the RAPs and the relevant regulatory authorities (e.g. OEH) to manage potential impacts on Aboriginal heritage values.

Table 9-6
Key Potential Impacts and Associated Project Outcomes – Amenity

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures	Project Outcome Summary
Potential amenity impacts of the continuation of the Dendrobium Mine surface facilities.		
The Project proposes only minor changes to the currently approved and operating surface facilities of the Dendrobium Mine (Section 3). Existing amenity impacts associated with the operation of these facilities would be extended from 2030 to 2048 under the Project. These primarily comprise ongoing Dendrobium Mine: • rail noise; • operational noise; • dust emissions; and • road transport noise.	South32 would continue and extend the current mitigation and monitoring framework for the management of amenity impacts from Dendrobium Mine surface facilities as described in the current environmental management plans, including the: • TMP; • Dendrobium Mine Driver's Code of Conduct; • NMP; and • AQMP. South32 would also continue the application of restricted rail haulage operating hours for the Kemira Valley Rail Line (between 6.00 am and 11.00 pm) and where reasonable and feasible, would implement further progressive rail noise mitigation measures over the life of the Project.	Existing amenity impacts associated with the operation of the Dendrobium Mine surface facilities would continue under the Project. South32 would comply with the requirements and criteria stipulated in the Development Consent, should the Project be approved.

Table 9-7
Key Potential Impacts and Associated Project Outcomes – Indirect Impacts

Summary of Potential Impact Mechanism	Summary of South32 Mitigation Measures	Project Outcome Summary
Potential impacts of Project greenhouse gas emissions, plus Scope 3 greenhouse gas emissions from the end use of Project coal.		
The Project's contribution to global climate change effects would be proportional to its contribution to global greenhouse gas emissions. Greenhouse gases directly generated at the Project (i.e. Scope 1 emissions) and indirect emissions associated with the on-site use of fuel and electricity (i.e. Scope 2 emissions) have together been estimated at approximately 825,469 t CO_2-e per year or 649,576 t CO_2-e per year (depending on whether pre- and post-gas drainage is vented or flared, respectively) (Section 6). These emissions would be much smaller than the Scope 3 emissions produced by customers using Project product coal. A portion of these Scope 3 emissions would occur in Australia, for example when Project coal is used at the BlueScope Steelworks or Whyalla Steelworks. It is acknowledged that (subject to the efficacy of national and international greenhouse gas abatement measures) all sources of greenhouse gas emissions will contribute in some way towards the potential global, national, state and regional effects of climate change (Section 9.3.4).	The existing greenhouse gas emissions associated with the operation of the Dendrobium Mine and the Australian end-of-use coal from the Dendrobium Mine are already reflected in Australia's greenhouse gas accounting. The Project would, however, facilitate a continuation of these existing greenhouse gas emissions. Australia's existing NDC under the Paris Agreement is a greenhouse gas emission reduction target of 26 to 28% on 2005 levels by 2030 (Commonwealth of Australia, 2015). This would include addressing, where relevant, the emissions of use of Project product coal in Australia. The Project's direct (Scope 1) greenhouse gas emissions would be minimised as far as possible, in particular through maximising gas flaring. Project-specific greenhouse gas minimisation measures would be described in a Greenhouse Gas & Energy Efficiency Management Plan for the Project. South32's Company-wide Climate Change Strategy reflects key strategies of the Paris Agreement, as it includes: • The target of staying below a baseline Scope 1 greenhouse gas emissions level (established based on financial year 2015) until 2021 (i.e. company-wide peak emissions would be reached between 2015 and 2021). • Reviewing and reducing greenhouse gas emissions every five years from 2021 to achieve a goal of net zero Scope 1 greenhouse gas emissions by 2050 (including carbon offsetting for any residual emissions). Where coal from the Project is used overseas, emissions associated with the end use of this coal would be managed by any NDC of these countries under the Paris Agreement.	The Project's contribution to global climate change effects would be proportional to its contribution to global greenhouse gas emissions. South32 has a Company-Wide Climate Change Strategy that reflects key strategies of the Paris Agreement.

The Economic Assessment indicates the Project would result in a total net benefit to the NSW economy of $1,073.2 million in NPV terms, inclusive of estimated costs for environmental externalities and internalisation of environmental management costs by South32 (Appendix L).

This net benefit includes some $497.8 million in total direct benefits to NSW in NPV terms, comprising (Appendix L):

- $74.9 million of net producer surplus attributable to NSW;
- $150.8 million in company tax attributable to NSW; and
- $272.1 million paid to the NSW and local governments, in the way of coal royalties, payroll tax, land taxes and council rates.

In addition to the direct economic impacts it is estimated the Project would generate $583.4 million in indirect economic impacts in NPV terms, comprising (Appendix L):

- a Project increase in worker benefit for the NSW economy of $365.8 million; and
- a Project net supplier benefit for the NSW economy of $217.6 million.

Further, Project coal production would continue to contribute to the continuation of manufacturing operations at the BlueScope Steelworks and Liberty Primary Steel Whyalla Steelworks, the operation of the Port Kembla Coal Terminal, NSW export income and industry in other countries that purchase Project product coal.

9.4.3 Strategic Context

Unlike some greenfield mining proposals that are developed to address general projected global commodity demand, the Dendrobium Mine is an existing metallurgical coal mine that has a high level of integration with its primary metallurgical coal customer, BlueScope Steelworks.

Strategic considerations that may be relevant in determining the Project include:

- The Project represents a continuation of mining in the Illawarra providing metallurgical coal to the BlueScope Steelworks at Port Kembla, supporting NSW regional manufacturing industries and significantly supporting the Illawarra and NSW economies.
- The Project is located in the Metropolitan Special Area, where access by the public is prohibited and most industries are thereby precluded from occurring. The extraction of coal resources by underground mining methods is therefore currently the only major revenue generating industry that is both compatible with the catchment status of these lands and permissible with consent.
- Review of historic underground longwall mining impacts from the Dendrobium Mine by the IEP (2018) indicates there has been no observed material impact to drinking water supplies due to mining to date.
- The Project is predicted to have negligible (less than 1%) impacts on total catchment yield and result in a net beneficial effect on water quality.
- While it is not considered economic for the Project to avoid undermining all ephemeral drainage lines, a number of mining constraints and setbacks have been adopted to reduce the likelihood of subsidence impacts to significant streams (i.e. named watercourses) and key stream features identified during field investigations. If physical damage to named streams and key stream features occurs due to the Project, remediation techniques would be implemented to repair the damage.
- Mining constraints have also been adopted to prevent damage to water supply infrastructure, in particular, the existing Avon and Cordeaux Dam walls and area of impounded water. Any mining within DSC Notification Areas would be subject to approval by the DSC under the *Dams Safety Act, 2015* (in addition to Development Consent for the Project under the EP&A Act) to confirm dam infrastructure and safety would be protected.
- Potential impacts on some upland swamps have been avoided and minimised through Project design. While it is not considered reasonable for the Project to avoid undermining all upland swamps, biodiversity offset measures have been developed consistent with government policy to address residual impacts to upland swamps that would be undermined by the Project.
- Conservative assumptions regarding potential Project subsidence impacts on stream features have been adopted for the derivation of biodiversity offset measures for species that may use these streams as habitat to maintain or improve biodiversity values.

- The Project maximises the continued use of existing South32 surface infrastructure to support the continuation of underground mining operations.
- The Project seeks to avoid a discontinuity in mining at the Dendrobium Mine caused by high gas coal in approved Area 3C, and avoid job losses/unemployment that would result from such a discontinuity.
- The Project represents a continuation and extension of the existing operations of a mine that provides metallurgical coal to BlueScope Steelworks at Port Kembla, supporting NSW regional manufacturing industries.
- The Dendrobium Mine also ships metallurgical coal to the Liberty Primary Steel Whyalla Steelworks, thereby also supporting other steel manufacturing in Australia.
- Greenhouse gas emission from the existing Dendrobium Mine, including the end use of its product coal, would be included in current greenhouse gas inventories. As the Project does not propose any increase in the currently approved rate of ROM coal production, greenhouse gas emissions from the Project and the end use of its coal represents a continuation of existing emissions.

9.4.4 Consideration of the Consequences of Not Carrying Out the Project

At 1 July 2019, it is estimated that approximately 33 Mt of ROM coal will remain in the approved underground mining areas.

In the absence of approval of the Project, South32 would undertake further analysis regarding the feasibility of extraction of some portions of Area 3C.

There would be significant time and costs associated with pre-drainage of gas from the coal measures (including the target Wongawilli Seam) in Area 3C to allow for the safe removal of the coal. There may also need to be a period of care and maintenance for the other parts of the Dendrobium Mine to provide sufficient time to safely conduct pre-drainage of gas from Area 3C. If a period of care and maintenance is required, this would necessitate a period of significantly reduced employment at the Dendrobium Mine until full mining operations can safely resume.

Were the Project not to proceed, the following consequences are inferred:

- 78 Mt of additional ROM coal extracted over the life of the Project would not be mined;
- approximately 400 existing employment opportunities would be discontinued following completion of currently approved mining activities at the Dendrobium Mine;
- an additional 200 direct construction employment opportunities and a peak of up 500 on-site direct operational employment opportunities and associated flow-on effects would not be created;
- additional tax revenue from the Project would not be generated (Appendix L);
- additional royalties to the State of NSW would not be generated (Appendix L);
- a net benefit of $1,073 million to the State of NSW and $431 million to the greater Wollongong Region in NPV terms would be forgone (Appendix L);
- the potential incremental environmental impacts described in this EIS would not occur;
- economic and social benefits to the region (including to the city of Wollongong and Wollondilly and Wingecarribee LGAs) associated with the Project would not be realised; and
- the Project biodiversity offsets and water quality offsets would not be established.

In addition, the cessation of the Dendrobium Mine would also have impacts on downstream industries that currently transport or directly utilise Project coal, including Port Kembla Coal Terminal, BlueScope Steelworks and Liberty Primary Steel Whyalla Steelworks.

9.5 CONCLUSION

The Project is a continuation of the existing approved Dendrobium Mine that would comply with applicable statutory requirements and relevant strategic planning policy objectives (Section 4 and Attachments 6 and 7).

This would provide for the continuation of employment of the existing Dendrobium Mine workforce of approximately 400 personnel, with approximately 100 additional operational jobs generated by the Project and approximately 200 additional jobs generated during surface facility construction and longwall development activities.

It would also contribute to the ongoing viability of existing suppliers and customers of the Dendrobium Mine, including the BlueScope Steelworks, the Liberty Primary Steel Whyalla Steelworks and the Port Kembla Coal Terminal.

There is currently no economically viable, commercial-scale alternative to the use of metallurgical coal in making steel using the blast furnace method, which is employed at the BlueScope Steelworks. Ongoing access to a consistent and local supply of metallurgical coal, which would be produced by the Project, has been recognised as a key factor in the ongoing economic viability of the BlueScope Steelworks.

Engagement with members of the public and key regulatory agencies in NSW and at a Commonwealth level has informed South32's design of the Project, including adoption of a range of avoidance measures to minimise impacts on named watercourses, mapped key stream features and existing WaterNSW water supply infrastructure.

South32 would apply offsets or other Project-specific measures to address key residual impacts on biodiversity, catchment yield and water quality (Tables 9-3 to 9-5 and Section 8).

The site is suitable for the proposed Project use, as underground coal mining by longwall methods is compatible with the catchment area status of much of the site (Sections 4 and 6) and the Project would generate a significant net benefit to the State of NSW (Section 6 and Appendix L).

Economic benefits potentially forgone if the Project does not proceed amount to a net benefit of $1,073 million in NPV terms to the State of NSW and $431 million in NPV terms to the greater Wollongong Region. This includes an estimated $272.1 million in royalties, payroll tax and council values in NPV terms.

In weighing up the main environmental impacts (costs and benefits) associated with the proposal as assessed and described in this EIS, the Project is on balance, considered to be in the public interest of the State of NSW.