ATTACHMENT 7

Aquifer Interference Policy Considerations and Water Licensing Addendum

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A7 AQUIFER INTERFERENCE POLICY CONSIDERATIONS AND WATER LICENSING ADDENDUM

This attachment provides further discussion on the requirements and application of relevant water licensing and associated approvals under the New South Wales (NSW) *Water Management Act, 2000*. It also provides a discussion of relevant requirements of the NSW Aquifer Interference Policy (the AIP) (NSW Government, 2012).

References to Sections 1 to 9 in this attachment are references to the sections of the Main Report of the Environmental Impact Statement (EIS). References to Appendices A to P in this Attachment are references to the Appendices of the EIS. Internal references within this attachment are prefixed with "A7".

A7.1 AQUIFER INTERFERENCE POLICY CONSIDERATIONS

A7.1.1 Aquifer Interference Policy Overview

The AIP (NSW Government, 2012) has been developed by the NSW Government as a component of the NSW Government's Strategic Regional Land Use Policy (Department of Planning and Infrastructure [DPI], 2012). The AIP applies state wide and details water licence and impact assessment requirements.

The stated objective of the AIP is to ensure equitable water sharing between various water users and proper licensing of water that is taken by aquifer interference activities to ensure that the take is accounted for in the water budget and water sharing arrangements.

The *Water Management Act, 2000* defines an aquifer interference activity as that which involves any of the following (which is adopted by the AIP):

- *the penetration of an aquifer,*
- *the interference with water in an aquifer,*
- *the obstruction of the flow of water in an aquifer,*
- *the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations, and*
- *the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.*

Examples of aquifer interference activities include mining, coal seam gas extraction, injection of water and commercial, industrial, agricultural and residential activities that intercept the water table or interfere with aquifers (NSW Government, 2012).

The AIP applies to all aquifer interference activities but has been developed in particular to address the following high risk activities (NSW Government, 2012):

- ***mining activities** such as open cut voids, underground mine workings and the disposal of water taken from an aquifer including water taken as part of coal seam gas extraction;*
- *other **extractive industries**, such as sand and gravel extraction...;*
- ***coal seam gas activities**, including those related to both exploration and production*
- *other large projects which require **dewatering** such as for the construction and maintenance of associated works, such as buildings, roads and other civil works;*
- ***injection works** used to transmit water into an aquifer; and*
- *activities with the potential to contaminate groundwater or result in unacceptable loss of storage or structural damage to an aquifer.*

Licensing Requirements

The *Water Management Act, 2000* makes it an offence for a person to "take" water without a water licence or otherwise than as authorised by the licence unless the person is exempt from the requirement for a licence.

The AIP states that all water taken by aquifer interference activities needs to be accounted for within the extraction limits set by the relevant water sharing plan.

A water access licence (WAL) is required where water is taken either incidentally or for consumptive use, or where any act by a person carrying out an aquifer interference activity causes (NSW Government, 2012):

- *the removal of water from a water source; or*
- *the movement of water from one part of an aquifer to another part of an aquifer; or*
- *the movement of water from one water source to another water source, such as:*
  - *from an aquifer to an adjacent aquifer; or*
  - *from an aquifer to a river/lake; or*
  - *from a river/lake to an aquifer.*

The AIP also requires consideration of the continued take of water from groundwater or connected surface waters following cessation of an aquifer interference activity.

The AIP states that licences are required to be held to adequately account for the ongoing take of water until the system returns to equilibrium, or alternatively, sufficient licences to account for the ongoing take of water are to be surrendered to the NSW Minister for Planning (the Minister) administering the *Water Management Act, 2000*.

Minimal Impact Considerations

WALs and approvals under the *Water Management Act, 2000* are not to be granted unless the Minister is satisfied that adequate arrangements are in place to ensure that "no more than minimal harm" is caused to a water source. In this regard, the AIP includes minimal impact considerations relating to water table and groundwater pressure drawdown and changes in groundwater and surface water quality.

The AIP provides (NSW Government, 2012):

> *Aquifer interference approvals[1] are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.*
>
> *While aquifer interference approvals are not required to be granted, the minimal harm test under the Water Management Act 2000 is not activated for the assessment of impacts. Therefore, this Policy establishes and objectively defines minimal impact considerations as they relate to water-dependent assets and these considerations will be used as the basis for providing advice to either the gateway process, the Planning Assessment Commission or the Minister for Planning.*

The AIP establishes minimal impact considerations for groundwater categories of both 'highly productive' and 'less productive' groundwater. 'Highly productive groundwater' is defined by the AIP as groundwater which (NSW Government, 2012):

> *...is defined in this Policy as a groundwater source that is declared in the Regulations and will be based on the following criteria:*
>
> *a) has total dissolved solids of less than 1,500 mg/L, and*
>
> *b) contains water supply works that can yield water at a rate greater than 5 L/sec.*

The AIP further groups highly productive groundwater into the following categories:

- Alluvial.
- Coastal sands.
- Porous rock, including:
  - Great Artesian Basin – Eastern Recharge and Southern Recharge;
  - Great Artesian Basin – Surat, Warrego and Central; and
  - other porous rock.
- Fractured rock.

The AIP similarly defines categories for less productive groundwater, which include:

- Alluvial.
- Porous rock.
- Fractured rock.

A7.1.2 Aquifer Interference Policy Requirements

An assessment of the Project against the licensing requirements and minimal impact considerations of the AIP is provided in the sub-sections below.

Relevant Water Sharing Plans

The AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant water sharing plan.

The water sharing plans in the vicinity of the Project are:

- Groundwater:
  - *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011.*
- Surface water:
  - *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011.*

[1] If an aquifer interference approval is required for the Project it would be obtained.

Groundwater

The Dendrobium Mine and the Project are located within the following groundwater sources (and management zones) of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Source 2011* (Figure A7-1):

- Sydney Basin – Nepean Groundwater Source (Management Zone 2 [MZ2]).
  - The Dendrobium Mine longwall areas are located entirely within MZ2.
  - Project Areas 5 and 6 would also be located within MZ2.
- Sydney Basin – South Groundwater Source:
  - The existing Dendrobium Mine underground access drives, located to the east of Dendrobium Area 1, are located within this source.

The following groundwater sources (and zones) are located adjacent to the groundwater sources listed above (Figure A7-1):

- Sydney Basin – Nepean Groundwater Source (Management Zone 1 [MZ1]), located approximately 4 km to the south of Project Area 5.
- Sydney Basin – Central Groundwater Source, located to the north of Cataract Dam and approximately 7 km from the Project underground mining areas.

Surface Water

The Project is largely located within the Upper Nepean and Upstream Warragamba Water Source under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011.*

Within this water source (Figure A7-2):

- Project Area 5 is located:
  - within the Upper Nepean River Tributaries Headwaters Management Zone; and
  - adjacent to the Avon River Management Zone.
- Project Area 6 is located:
  - within the Upper Nepean River Tributaries Headwaters Management Zone; and
  - adjacent to the Cordeaux River Management Zone.

East of the Illawarra Escarpment, the Project is located within the Illawarra Rivers Water Source under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*.

Within this water source Project coal handling infrastructure is located within the Wollongong Coastal Management Zone, which extends from the escarpment to the Pacific Ocean (Figure A7-2).

No Project extraction of surface water is proposed in the Illawarra Rivers Water Source.

Water Licensing Requirements

Details of the current WALs held by Illawarra Coal Holdings Pty Ltd (Illawarra Coal) for the Dendrobium Mine are summarised in Table A7-1.

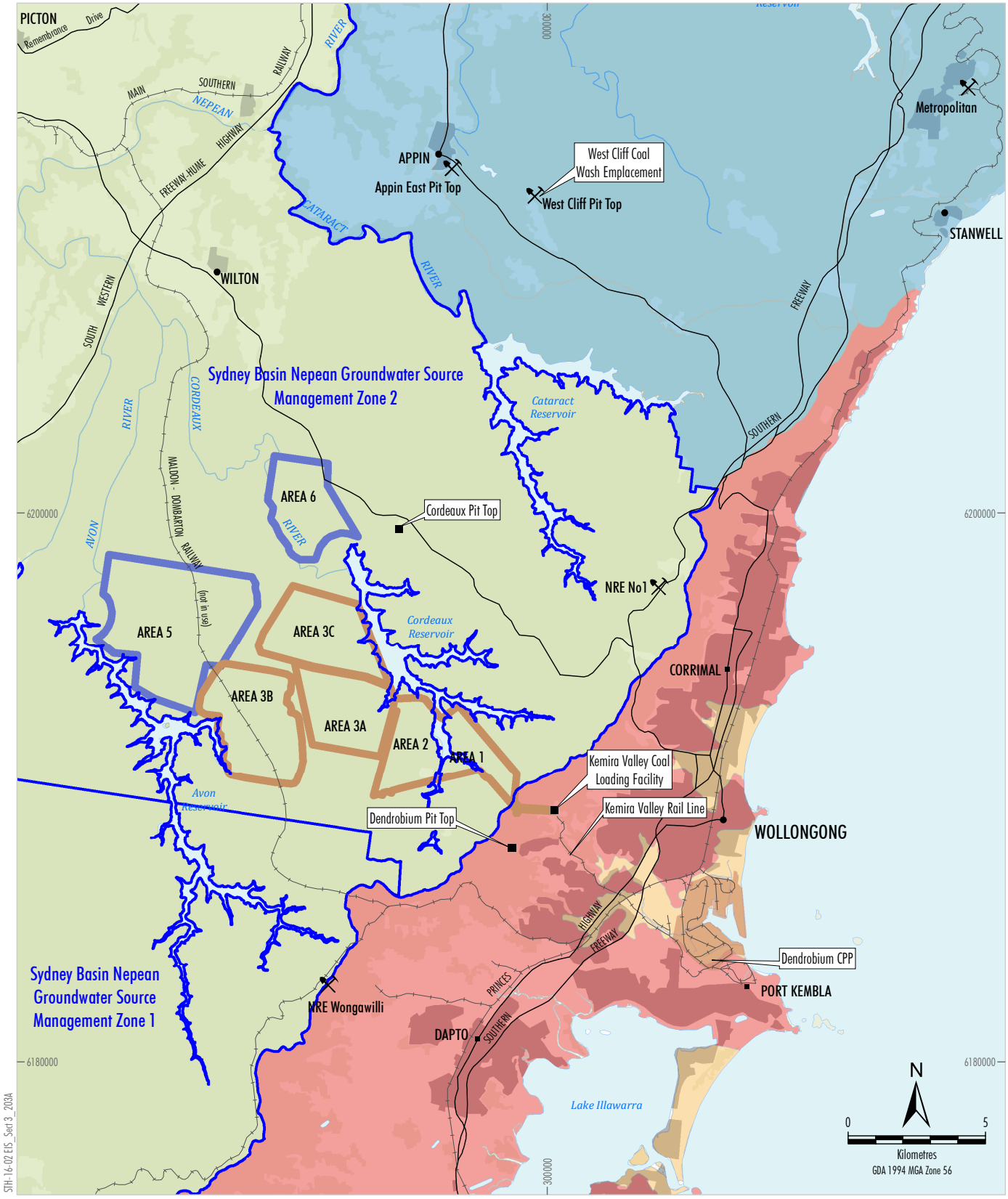
Dendrobium Mine Licensing Requirements

Sufficient licences for groundwater inflows to the current underground mining operations are held for the groundwater sources in which the Project is physically located (i.e. Sydney Basin – Nepean [MZ2] for the underground mining areas, and Sydney Basin – South for the access drives).

When the Dendrobium Mine was approved in 2001, the *Water Management Act, 2000* had not been commenced and applicable water sharing plans were not developed, or in force (i.e. the water sharing plans applicable to the Dendrobium Mine came into force in mid-2011).

The Dendrobium Mine therefore originally obtained relevant water licensing requirements via the previous applicable legislation (the *Water Act, 1912*).

The requirement to account for modelled induced take from surrounding water sources (i.e. not the source in which the mine is physically located) became relevant with the apportionment of water resources throughout NSW into a series of adjoining and/or overlying water sources via the *Water Management Act, 2000* and the subsequent requirements of the AIP (NSW Government, 2012) for proponents to licence modelled incidental water take from adjoining sources.



LEGEND

- Road
- Railway
- Urban Area
- Dendrobium Underground Mining Area - Project Proposed
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
- Nepean Management Zones
- Sydney Basin Nepean Groundwater Source
- Sydney Basin South Groundwater Source
- Sydney Basin Central Groundwater Source
- Metropolitan Coastal Sands Groundwater Source

Source: Geoscience Australia, 2006; Department of Industry (2018); Department of Finance, Services & Innovation (2018);

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Illawarra Coal

DENDROBIUM MINE

Relevant Management Zones - Greater Metroplitan Region Groundwater Source 2011

Figure A7-1

LEGEND

- Road
- Railway
- Urban Area
- Dendrobium Underground Mining Area - Project Proposed
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
- Management Zone
- Illawarra Rivers Water Source
- Upper Nepean and Upstream Warragamba Water Source

Source: Geoscience Australia, 2006; Department of Industry (2018); Department of Finance, Services & Innovation (2018); DI Water (2017)

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DENDROBIUM MINE

Relevant Mangement Zones - Greater Metropolitan Region Unregulated River Water Sources 2011

Figure A7-2

Table A7-1
Existing Water Licensing Summary for the Dendrobium Mine

Water Sharing Plan	Water Source (Management Zone)	Licence Category	WAL Number	Allocation (Shares)
Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011	Sydney Basin – Nepean (MZ2)	Aquifer	37464	300
			37465	3,962
			42386	3,653
			42385	1,840
	Sydney Basin – South	Aquifer	36473	75

In parallel with the increasing sophistication of NSW water regulation, the modelling and assessment of potential groundwater and surface water impact assessment in NSW has become more sophisticated as computer processing capability and modelling complexity have evolved.

The combination of increased modelling capability and the need to licence incidental water take from adjoining sources typically now requires licensing from water sources/management zones adjacent to the source/zone in which the activity physically occurs. This is to account for induced losses and associated movement of water across source/zone administrative boundaries resulting from groundwater depressurisation [2].

Due to the status of the Metropolitan Special Areas there is no water licence market for some groundwater and surface water sources/zones that are largely or wholly located within the protected catchments. South32 is therefore reliant on the NSW Government creating additional licences or entitlements in the applicable Water Sharing Plan management areas and zones to account for modelled indicated takes from adjoining sources.

Project Licensing Requirements

Project licensing requirements have been estimated using the groundwater model for the Project. The approach is consistent with that outlined in Section 2.1 of the AIP, which states “the predictions should be based on complex groundwater modelling and conducted in accordance with the Australian Groundwater Modelling Guidelines”.

A range of conservative assumptions, consistent with recommendations by the Independent Expert Panel for Mining in the Catchment (2018), have been adopted in groundwater modelling (Appendix B and Attachment 5), including:

- The height of fracturing and groundwater depressurisation applied to the groundwater model has been estimated using geomechanical modelling for longwall panels with void width of 305 metres (m), producing results greater than those estimated using the ‘Tammetta Equation’. The Tammetta Equation has been used to estimate heights of fracturing and depressurisation for longwall panels with void width less than 305 m.
- For the calibration period (which includes mining in Areas 1, 2, 3A and 3B of the Dendrobium Mine), the model overpredicted historic groundwater inflows to the Dendrobium Mine by approximately 20 per cent (%).
- The groundwater modelling assumes predicted surface water losses are lost to the groundwater system, whereas a portion of any surface water diverted from streams may re-emerge as surface water downstream.

The result of the application of these assumptions is the modelled licensing requirements are likely to be conservatively high.

Table A7-2 provides estimated peak water licencing requirements of the Dendrobium Mine and the incremental demands of the Project based on the conservative assumptions adopted in the groundwater assessment.

[2] Noting that the modelled movement of water between administrative groundwater sources or management zones cannot typically be observed, or measured, in practice.

Table A7-2
Estimated Water Licensing Requirements for the Project

Water Sharing Plan	Water Source (Management Zone)	Allocation (Shares) held by South32	Maximum Dendrobium (inclusive of Project) Licensing Requirement (ML/year)[1]	Maximum Project Increment
Water Sharing Plan for the Greater Metropolitan Region ***Groundwater*** *Sources 2011*	Sydney Basin – Nepean (MZ2)	9,455^	6,700	5,700
	Sydney Basin – Nepean (MZ1)	-	32	7
	Sydney Basin – South	75	4	3
Water Sharing Plan for the Greater Metropolitan Region Unregulated ***River Water*** *Sources 2011*	Upper Nepean and Upstream Warragamba Water Source	-	3,330	1,935
	Illawarra Rivers Water Source	-	10	3
	Total – all water sources	**9,530**	**9,490[2]**	**-**

After: HydroSimulations (2019)

ML/year = Megalitres per year

^ Refer Table A7-1 for a breakdown of this volume.

[1] Licensing requirement for groundwater includes direct pit inflows from the porous rock and induced leakage from surface water systems.

[2] Peak annual predicted licensing requirement from all water sources in any given Project year. This total does not equal the sum of peak licensing requirements in each individual source/zone, as these peaks do not occur in the same Project year.

As shown, South32 holds total licences sufficient to account for the peak predicted groundwater inflow to the underground mine (i.e. for the Dendrobium Mine plus the Project increment).

These licenses are held for the groundwater sources in which the Project is physically located (i.e. Sydney Basin – Nepean [MZ2] and Sydney Basin – South for the access drives) (Table A7-1).

While South32 has sufficient volumetric entitlements to account for direct groundwater inflow, the WALs held by South32 are not currently distributed to all of the administrative water sources and management zones modelled to experience some impact from the Dendrobium Mine and the Project (Table A7-2).

Due to existing restrictions on the availability of licences in the water sources that the Project is not physically located within, South32 is reliant on the NSW Government creating additional licences or entitlements available to facilitate the development of the Project in the applicable adjoining Water Sharing Plan management areas and zones.

Post-mining Licensing Requirements

Following the cessation of the Project, groundwater extraction from the underground workings would cease. That is, there would be no further "take" from the Sydney Basin – Nepean Groundwater Source (MZ2) (i.e. the groundwater source in which the underground mining areas are located).

While groundwater accumulates in the mine as recovery occurs and/or fracture networks fill and losses reduce to negligible levels over time, residual impacts on surface water flows in the catchment above the longwalls and/or ongoing movement of groundwater between adjacent groundwater sources or management zones may occur. However, post-mining licence requirements would be lower than the peak licences required during operations.

South32 would therefore hold or retire sufficient licences to account for post-mining takes of water. Residual licences held by South32 would be available for sale or use at another mining operation.

The numerical groundwater model would be refined over the mine life in order to more accurately calculate the post-mining licensing requirements associated with the Project.

Minimal Impact Considerations

The AIP establishes minimal impact considerations for 'highly productive' and 'less productive' groundwater.

The Sydney Basin Porous Rock in the vicinity of the Project is 'highly productive' in accordance with the AIP.

Table A7-3 provides an assessment of the Project against the water table, water pressure and water quality minimal impact in accordance with the AIP.

The Project would have 'minimal impact' (as defined by the AIP) for the 'highly productive' porous rock aquifer (Table A7-3 and Appendix B).

A7.2 WATER MANAGEMENT ACT, 2000

Consideration of the Project against the objects, water management principles and access licence dealing principles under the *Water Management Act, 2000* and a discussion of the licences and approvals required for the water sources associated with the Project is provided below.

A7.2.1 Objects of the Act

Section 3 of the *Water Management Act, 2000* outlines the objects of the Act:

> *The objects of this Act are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular:*
>
> *(a) to apply the principles of ecologically sustainable development, and*
>
> *(b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality, and*
>
> *(c) to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:*
>
> *(i) benefits to the environment, and*
>
> *(ii) benefits to urban communities, agriculture, fisheries, industry and recreation, and*
>
> *(iii) benefits to culture and heritage, and*
>
> *(iv) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water,*

Table A7-3
Minimal Impact Considerations for Highly Productive Porous Rock Aquifer

Aquifer	Sydney Basin Porous Rock Sydney Basin – Nepean and Sydney Basin – South Groundwater Sources (*Greater Metropolitan Groundwater Sources 2011*)
Category	Highly Productive Groundwater Source

Minimal Impact Considerations	Assessment
Water table 1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or "culturally" significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.	There are no High Priority Groundwater Dependent Ecosystems (GDE) listed in the *Water Sharing Plan for the Greater Metropolitan Groundwater Sources 2011* within 14 km of the Dendrobium Mine (and the Project) (Appendix B). There are no High Priority culturally significant sites listed in the *Water Sharing Plan for the Greater Metropolitan Groundwater Sources 2011* in the Groundwater Assessment Study Area (Appendix B). The Groundwater Assessment for the Project (Appendix B) predicts that there is a very low risk of drawdown in excess of the water supply work drawdown criterion due to mining activities at the Dendrobium Mine (and the Project). This applies to any 'water supply works' within the Permo-Triassic or shallow strata. There are no other relevant water supply works. **Project complies with Level 1 minimal impact considerations** (Appendix B).
Water pressure 1. A cumulative pressure head decline of not more than 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	The Groundwater Assessment for the Project (Appendix B) predicts that no water supply works would be affected by drawdown from the Project. The suite of sensitivity runs also suggest that the number 'water supply' works to be affected by operations at the Dendrobium Mine (and the Project) is likely to be zero, with sensitivity results indicating that up to 5 would be affected more than 2 m if changes to model parameters are made (Appendix B). **Project complies with Level 1 minimal impact considerations** (Appendix B).
Water quality 1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	Mining-induced changes to the hydraulic properties and depressurisation of the strata in the Dendrobium Mine area may result in mixing of potentially chemically different groundwater between overlying and underlying units (Appendix B). However, it is considered unlikely that this will result in change to the beneficial uses of groundwater in the Permo-Triassic rock units. The risk of water quality impacts decreases with distance from the mine footprint (Appendix B). **Project complies with Level 1 minimal impact considerations** (Appendix B).

(d) to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,

(e) to provide for the orderly, efficient and equitable sharing of water from water sources,

(f) to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,

(g) to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,

(h) to encourage best practice in the management and use of water.

The Project is considered to be consistent with the objects of the *Water Management Act, 2000*, given:

- The Project would be consistent with the principles of ecologically sustainable development (ESD) (Section 9.3.5).
- Mitigation, monitoring and/or offset measures would be implemented to minimise potential impacts on downstream surface water flows, aquifers, water quality, aquatic ecosystems and biodiversity (Sections 3.9 and 6).
- A cumulative assessment of potential impacts of the Project on groundwater and surface water has been conducted as part of this EIS (Appendices B and C). No material adverse impacts on urban communities, regional agriculture, fisheries, industry or recreation are predicted to arise due to Project water use or water management. The cost benefit analysis in the Economic Assessment (Appendix L) indicates a significant net economic benefit would be forgone if the Project's use of water resources (in accordance with the requirements of the *Water Management Act, 2000*) was not to occur.
- Community consultation regarding the Project is described in Section 5 and Appendix K, including, where relevant, feedback received from the community regarding Project water use and water management.
- Potential groundwater inflows and surface water containment requirements are described in Sections 3.9, 6.5 and 6.6. Water licensing and approval requirements for the Project are described in Section A7.1.2.
- The Project Groundwater Assessment (Appendix B), Surface Water Assessment (Appendix C), Biodiversity Assessment Report and Biodiversity Offset Strategy (Appendix D) and Aquatic Ecology Assessment (Appendix E) have been prepared in an integrated manner.
- The objectives for the Project water management system include minimisation of the volume of water to be obtained from external water sources and the Project proposes the beneficial re-use of excess mine water for industrial purposes (Section 3).
- An Extraction Plan would be developed for the Project that describes measures/procedures to respond to potential exceedances of water-related criteria, and contingent mitigation, compensation and/or offset options that are enacted in the event that Project predicted impacts are exceeded (Sections 6.5 and 6.6).

A7.2.2 Water Management Principles

Section 5 of the *Water Management Act, 2000* outlines the water management principles:

5 Water management principles

(1) The principles set out in this section are the water management principles of this Act.

(2) Generally:

(a) water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded, and

(b) habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored, and

(c) the water quality of all water sources should be protected and, wherever possible, enhanced, and

(d) the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised, and

(e) geographical and other features of Aboriginal significance should be protected, and

(f) geographical and other features of major cultural, heritage or spiritual significance should be protected, and

(g) the social and economic benefits to the community should be maximised, and

(h) the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

(3) In relation to water sharing:

(a) sharing of water from a water source must protect the water source and its dependent ecosystems, and

(b) sharing of water from a water source must protect basic landholder rights, and

(c) sharing or extraction of water under any other right must not prejudice the principles set out in paragraphs (a) and (b).

Section 9 of the *Water Management Act, 2000* makes it the duty of all persons exercising functions under the Act to take all reasonable steps to exercise those functions in accordance with water management principles.

The Project is considered to be consistent with the principles of the *Water Management Act, 2000*, given that:

- As described above, cumulative assessments for impacts on groundwater and surface water have been conducted (Appendices B and C) as part of this EIS. Mitigation, monitoring, offsets, and/or adaptive management would be implemented to minimise potential impacts on water sources (Sections 3.9, 6.5.4, 6.5.5, 6.6.4 and 6.6.5).
- Section 7 presents the rehabilitation strategy for the Project. Section 6.9 summarises the Project Biodiversity Offset Strategy and compensatory measures that would assist in maintaining the biodiversity of the region, including consideration of native vegetation and fauna species.
- With the proposed mitigation, monitoring, offsets, and adaptive management measures in place, dealings associated with the Project are not expected to adversely affect the ability of a person to exercise their basic landholder rights (noting the Project Areas 5 and 6 in the Metropolitan Special Area are a significant distance from any private landholdings).
- Sections 6.5, 6.6 and 6.10 summarise the potential impacts of the Project on groundwater, surface water and Aboriginal cultural heritage and outline the proposed mitigation and adaptive management measures where relevant.
- Sections 6.19 and 9 summarise the expected economic outcomes if the Project is approved.

A7.2.3 Access Licence Dealing Principles

The *Access Licence Dealing Principles Order 2004* outlines the access licence dealing principles that prevail over the access licence dealing rules of water sharing plans to the extent of any inconsistency.

Clause 7 of the *Access Licence Dealing Principles Order 2004* relevantly states:

7 Impacts on water sources

(1) Dealings should not adversely affect environmental water and water dependent ecosystems as identified in any relevant management plan.

(2) Dealings should be consistent with any strategies to maintain or enhance water quality identified in any relevant management plan.

(3) In unregulated river water sources, dealings should not increase commitments to take water from water sources or parts of water sources identified in any relevant management plan as being of high conservation value.

(4) In unregulated river water sources or a groundwater source, dealings should not increase commitments to take water from water sources or parts of water sources above sustainable levels identified in any relevant management plan.

(5) In regulated river water sources, dealings should not increase daily demand for water delivery at those locations and times where it is identified in any relevant management plan that demand exceeds delivery capacity.

*(6) In this clause, **commitments to take water** refers, in relation to all access licences with nominated works in that water source or part of a water source, to:*

(a) the total volume of water allocations in water allocation accounts, or

(b) where relevant, the sum of limits on rates of extraction in extraction components.

Based on the modelling conducted in this EIS, South32 has sufficient volumetric water licences to cover all of the water take predicted for the Project, however, this volume is not currently apportioned to the appropriate administrative sources (Section A7.1.2).

The nearest High Priority GDE's are located along O'Hares Creek and the Macquarie Rivulet Estuary. O'Hares Creek catchment is approximately 14 kilometres (km) north-east of Project Area 6, and Macquarie Rivulet is about 16 km south of Dendrobium. No drawdown effects are predicted to occur at these locations as a result of mining at the Dendrobium Mine and the Project (Appendix B).

The Groundwater Assessment for the Project (Appendix B) concludes that groundwater drawdown is unlikely to exceed AIP minimal impact criterion at any water supply works as a result of the Project. Further, the predicted impacts of the Project on surface water flow are negligible when considered at a catchment scale (Section 6.6) and the flows in the Cordeaux River and Avon River are already highly regulated by the operation of the Cordeaux and Avon Dams.

After mining, groundwater levels are likely to equilibrate over many decades (Appendix B). In Project Area 5, modelling suggests that groundwater levels in the deeper units may recover to greater pressures than in shallower strata, leading to the possibility of an upward gradient. This may result in some poorer quality water from the coal measures upwelling in the goaf and fractured zones, with the potential to reduce the quality of water in the shallower strata. However, there would be significant dilution from surrounding groundwater in the shallower units and no change in the beneficial use of the groundwater would occur (Appendix B). The modelling suggests that this upward gradient is less likely in Project Area 6, where a downward gradient is predicted in the long term (Appendix B).

Mitigation, monitoring, offset, and/or adaptive management measures to minimise potential impacts on water quality are described in Sections 6.5.4, 6.5.5, 6.6.4 and 6.6.5.

The following sections provide detail on each of the water sharing plans that are potentially relevant to the licensing requirements of the Project.

A7.2.4 Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011

Under the *Water Management Act, 2000*, the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* commenced on 1 July 2011.

Applicable Waters

Clause 4 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* provides that the plan applies to the following waters:

> *(1) This Plan applies to the following groundwater sources (hereafter **these groundwater sources**) within the Southern Water Management Area, the Hawkesbury-Nepean Water Management Area, the Southern Sydney Water Management Area, and the Sydney Harbour Water Management Area:*
>
> *…*
>
> *(j) Sydney Basin Nepean Groundwater Source,*
>
> *…*
>
> *(m) Sydney Basin South Groundwater Source.*
>
> *…*
>
> *(3) These groundwater sources, … include all water contained within all aquifers below the surface of the ground shown on the Plan Map.*

Existing South32 Water Access Licences

Table A7-1 summarises licences held by South32 in the Sydney Basin – Nepean Groundwater Source (MZ2) and Sydney Basin – South Groundwater Source within the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011.*

Access Licences and Dealing Rules

There are a number of mechanisms within the *Water Management Act, 2000* (called access licence dealings) that allow changes to access licences, for example, changes to the holder of an access licence, or the location within a water source at which water can be extracted.

Part 10 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* outlines the access licence dealing rules that apply to dealings under the *Water Management Act, 2000*.

In summary these dealing rules prohibit conversion of access licences to a new category (clause 46); change of groundwater source (clause 48); and interstate access licence transfer (clause 51). These dealing rules also restrict other dealings that in the opinion of the Minister administering the act may significantly adversely affect an aquifer; or restrict variation with respect to the management zone specified in the licence (clauses 47, 59, 50 and 52).

The net effect of Part 10 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* is that while South32 has sufficient allocation of WALs under the Sydney Basin – Nepean MZ2 (i.e. where the Project underground mine is located) in the Sydney Basin – Nepean Groundwater Source to account for the entire Project groundwater take, an administrative change to transfer a small portion of South32's licenced volume to the Sydney Basin – Nepean MZ1 (i.e. to address incidental take from this adjoining zone) cannot be made.

The NSW Government can undertake further controlled allocations in applicable management zones in accordance with section 65 of the *Water Management Act, 2000* to resolve the current administrative limitations.

A7.2.5 Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011

Under the *Water Management Act, 2000*, the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* commenced on 1 July 2011.

Applicable Waters

Clause 4 of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* provides that the plan applies to the following waters:

> *(1) This Plan applies to the Greater Metropolitan Region Unregulated River Water Sources which is comprised of the following water sources (hereafter **these water sources**) within the Southern Water Management Area, the Hawkesbury Nepean Water Management Area, the Southern Sydney Water Management Area, and the Sydney Harbour Water Management Area:*
>
> *…*
>
> *(b) Illawarra Rivers Water Source,*
>
> *(c) Upper Nepean and Upstream Warragamba Water Source,*
>
> *…*
>
> *(3) Subject to subclause (4), these water sources include all water:*
>
> *(a) occurring naturally on the surface of the ground within the boundaries of these water sources shown on the Plan Map, and*
>
> *(b) in rivers, lakes, estuaries and wetlands within the boundaries of these water sources show on the Plan Map.*
>
> *(4) These water sources do not include water contained in:*
>
> *(a) the coastal sands,*
>
> *(b) any fractured rocks or porous rocks,*
>
> *(c) the area below the mangrove limit,*
>
> *(d) (Repealed)*
>
> *(e) any alluvial sediments, and*
>
> *(f) the Mooney Mooney Creek Water Source and the Mangrove Creek Water Source as defined in the Water Sharing Plan for the Central Coast Unregulated Water Sources 2009.*

The Project would involve indirect or induced surface water take (via fracture networks and groundwater depressurisation induced losses) therefore the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* is applicable to the Project.

Access Licences

South32 does not currently hold access licences under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* for predicted induced surface water losses (Section A7.3). However, South32 has access to sufficient groundwater licence allocations under the Sydney Basin – Nepean Groundwater Source MZ2 to account for the volume of surface water predicted to report to deeper groundwater systems (Table A7.2).

Access Licence Dealing Rules

Part 11 of *the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* outlines the access licence dealing rules that apply to dealings under the *Water Management Act, 2000*.

In summary, these dealing rules prohibit: change of water source (clause 66); and interstate access licence transfer (clause 69) under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*. These dealing rules also restrict other dealings such that South32 is not able to assign rights to extract water from either above or below the Avon and Cordeaux Dams to alternative management zones above or below these structures (clause 65).

As discussed above, based on the modelling conducted for this EIS, South32 has sufficient volumetric water licences to cover all of the water take predicted for the Project. However, some of this volume is not currently apportioned to the correct administrative sources (Section A7.1.2).

However, the net effect of the restrictions of Part 11 of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* is that an administrative change to transfer portions of South32's licenced volume to applicable surface water sources and management areas is not available. South32 would therefore be required to acquire relevant additional access licences in the management zones where induced surface water take is predicted to occur. Potentially relevant management zones include the Upper Nepean Tributaries Headwaters Management Zone, Cordeaux River Management Zone and Avon River Management Zone in the Upper Nepean and Upstream Warragamba Water Source.

The NSW Government can undertake further controlled allocations in applicable management zones in accordance with section 65 of the *Water Management Act, 2000* to resolve the current administrative limitations.

A7.3 CONCLUSION

The Project is located in the Metropolitan Special Area (Section 1). Water Sources and management areas within the water sharing plans developed for the Metropolitan Special Area under the *Water Management Act, 2000* reflect the restricted public access and very limited commercial uses that are permissible within these protected areas.

Applicable water sources and management zones within the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* and *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* therefore have more restrictive conditions than is typical in other locations in NSW. There is also generally no, or very little, market for water licences within applicable zones as the WALs are held by WaterNSW.

When the Dendrobium Mine was approved in 2001, the *Water Management Act, 2000* had not been commenced and applicable water sharing plans were not developed, or in force (i.e. in the Project area applicable water sharing plans came into force in mid-2011). The Dendrobium Mine therefore originally obtained all relevant water licensing requirements via the previous applicable legislation (the *Water Act, 1912*).

The requirement to account for induced take from surrounding water sources (i.e. not the source in which the mine is physically located) became relevant with the apportionment of water resources throughout NSW into a series of adjoining and/or overlying water sources via the *Water Management Act, 2000* and the subsequent requirements of the AIP (NSW Government, 2012) for proponents to licence modelled incidental water take from adjoining sources.

In parallel with the increasing sophistication of NSW water regulation, the modelling and assessment of potential groundwater and surface water impact assessment in NSW has become more sophisticated as computer processing capability and modelling complexity have evolved.

The combination of increased modelling capability and the need to licence incidental water take from adjoining sources typically now identifies and requires licensing of lessor volumes of water that may be induced by project changes in groundwater pressure to move between water source administrative boundaries[3].

As the Dendrobium Mine and other Southern Coalfield mines have been operating in the Metropolitan Special Area for decades these indirect or induced takes of water would have been occurring historically. However, the previous NSW regulatory regime did not identify or require licensing of these incidental volumes moving between water source administrative boundaries.

[3] Noting that the modelled movement of water between administrative groundwater sources or management zones cannot typically be observed, or measured, in practice.

For the Project EIS, South32 has adopted a range of conservative assumptions and the modelled groundwater inflows, associated induced groundwater take and surface water losses are considered to be conservative given:

- The height of fracturing and groundwater depressurisation applied to the groundwater model has been estimated using geomechanical modelling for longwall panels with void width of 305 m, producing results greater than those estimated using the 'Tammetta Equation'. The Tammetta Equation has been used to estimate heights of fracturing and depressurisation for longwall panels with void width less than 305 m.
- For the calibration period, the model overpredicted historic groundwater inflows to the Dendrobium Mine by approximately 20%.
- The groundwater modelling assumes predicted surface water losses are lost to the groundwater system, whereas a portion of any surface water diverted from streams is likely to remerge as surface water downstream.

The net result of the application of these conservative assumptions is that the modelled incidental or induced take from adjacent groundwater sources, and the estimated volume of surface water modelled to report to deeper groundwater systems are higher, and this correspondingly will require South32 and the NSW Government to address additional licensing requirements for modelled incidental take from adjoining and overlying administrative water source areas.

A7.4 REFERENCES

Department of Planning and Infrastructure (2012). *NSW Government's Strategic Regional Land Use Policy.*

HydroSimulations (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Groundwater Assessment.*

Independent Expert Panel for Mining in the Catchment (2018). *Initial Report on Specific Mining Activities at the Metropolitan and Dendrobium Coal Mines.*

NSW Government (2012) *NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities*.