2 October 2020

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Stephen O'Donoghue
Director Resource Assessments
Department of Planning, Industry and Environment

via email: stephen.odonoghue@planning.nsw.gov.au

Dear Stephen,

RE: DENDROBIUM MINE – RESPONSE TO FURTHER BIODIVERSITY QUERIES

In response to additional queries received from the Department of Planning, Industry and Environment (DPIE) regarding biodiversity on 17 September 2020, please find attached supplementary information provided by South32 (Enclosure 1).

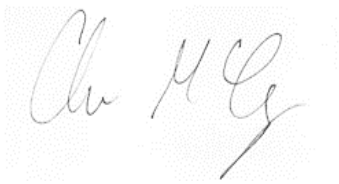
The purpose of this letter and its enclosure is to provide further clarification in response to residual queries from DPIE, particularly in regard to the following:

- Upland Swamp Threatened Ecological Community classification and significance assessment;
- biodiversity offset properties; and
- relevant biodiversity policy and proposed offset strategy.

If you have any queries please don't hesitate to contact me (Chris.McEvoy@south32.net or 0407 060 163).

Yours sincerely

SOUTH32 LIMITED



Chris McEvoy
Approvals Manager
Dendrobium Next Domain Project

ENCLOSURE 1

SUPPLEMENTARY BIODIVERSITY INFORMATION – RESPONSE TO DPIE

SUPPLEMENTARY BIODIVERSITY INFORMATION – RESPONSE TO DPIE

Upland Swamp Significance

Table 12 of the original BAR assesses all upland swamps in the BAR's study area according to OEH 'special significance criteria', and finds that only Den098 satisfies 3 of those criteria and is therefore of 'special significance'. Can you pls confirm this, noting that one of the criteria satisfied is "closely proximate habitat", which (it would seem) should either apply to all of the 46 swamps or none of them.

Also the BAR states on p. 34 that Den98 will be subject to "additional monitoring because of this 'special significance' status. However, I can find no description elsewhere in the BAR about what this would entail. Can you please describe the additional monitoring proposed, if it remains applicable.

Response:

OEH's (2012) *Upland Swamp Environmental Assessment Guidelines – Guidance for the underground mining industry operating in the Southern Coalfield* provides that a swamp is of special significance if it satisfies at least three of the following criteria:

- Statutory threshold.
- Swamp size.
- Unusual complexity.
- Closely proximate habitat.
- Scientific research importance.

As per the OEH (2012) mapping, no swamps within the study area satisfied the 'swamp size' or 'scientific research importance' criteria. However all swamps within the Project study area were assumed by Niche (2019) to satisfy the 'statutory threshold' criterion due to the presence of Upland Swamp Threatened Ecological Communities (TECs).

A handful of the swamps within the study area were also determined by Niche (2019) to satisfy the 'closely proximate habitat' criterion. OEH (2012) provides that a swamp is considered to satisfy the 'closely proximate habitat' criterion if it occurs in one of the following four key clusters of swamps:

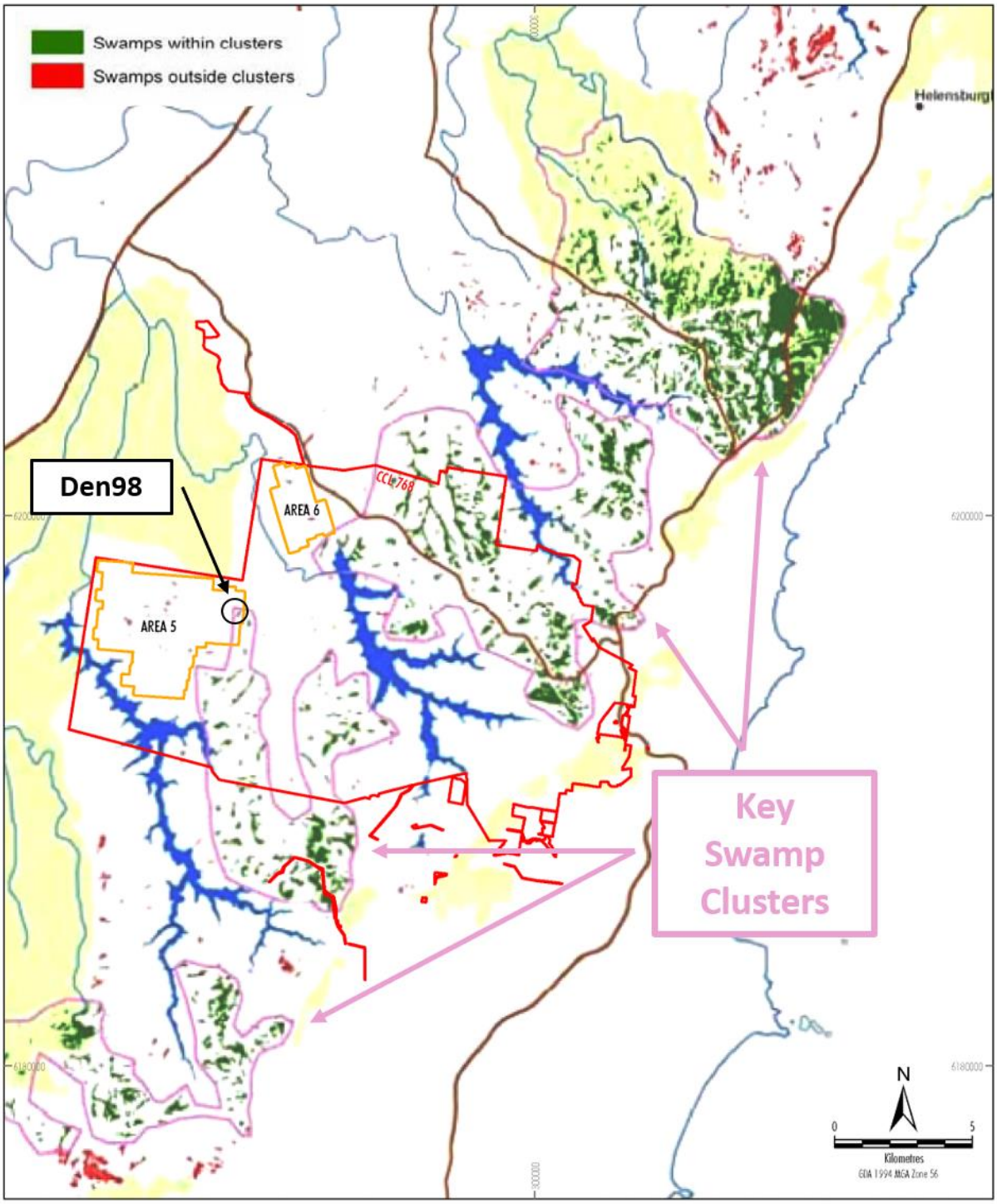
- Maddens Plains (O'Hares and Cataract catchments).
- Wallandoola Creek (Cataract catchment).
- North Pole (southern Avon catchment).
- Stockyard (southern Nepean catchment).

Map 5, Appendix 1 of OEH (2012) (reproduced below for reference) shows the key swamp clusters within pink boundaries. Swamps outside of the pink boundaries are not significant under the 'closely proximate habitat' criterion.

Den98, Den01b, Den02, Den124, Den 131, Den132 and Den 138 are the only swamps within the study area that occur on the edge of one of the key clusters of Upland Swamps shown in Map 5 of OEH (2012). Of these, Den98 is the only one which is within 60 metres of the proposed longwall layout. The remaining swamps in the study area do not occur within a cluster.

A swamp is significant under the 'unusual complexity' criterion if field survey verifies the presence of all three TEC vegetation sub-units (i.e. 'Coastal Upland Swamps Banksia Thicket' [MU42], 'Coast Upland Swamps Tea-tree Thicket' [MU43] and 'Coastal Upland Swamps Sedgeland-Heath Complex' [MU44]). Only Den98 satisfied the 'unusual complexity' criterion (as verified during vegetation validation surveys [refer Table 10 of the BARBOS]) in addition to two other criteria ('statutory threshold' and 'closely proximate habitat') and on this basis was classified by Niche (2019) as being of special significance.

Additional monitoring to reflect the special significance of these swamps would be detailed in Project Extraction Plans and may include subsidence, flora transects and plot data, shallow piezometers and soil moisture analysis against relevant control/reference swamps. If relevant, outcomes of monitoring and analysis would be reported separately within Annual Reports.



Map 5: Woronora swamps in large clusters

Source: OEH (2012)

Upland Swamp Classification

Table 10 in the BAR categorises the 46 swamps as headwater (33), valley infill (12) or hybrid (1), based on what the accompanying text says is a GIS analysis. However, careful review of Drawing 12 in the Subsidence Assessment (swamps, streams and topo contours) does not straightforwardly support this categorisation. Rather, it raises a number of questions, particularly about additional hybrid swamps, but also re a number of narrow linear swamps within stream valleys being categorised as headwater swamps. Can you please confirm the basis on which the categorisation was carried out and provide any updates considered necessary. As discussed, I will propose that more detailed field work is done on this matter post-determination.

Response:

It is noted the classification of swamp types as either headwater or valley in-fill does not influence the outcomes of the biodiversity impact assessment in the Project *Biodiversity Assessment Report and Biodiversity Offset Strategy* (Niche, 2019) (BARBOS), nor have any impact on the biodiversity offset liability determined for the Project.

The landscape position of Upland Swamps is a key determining factor for categorisation, and as such, GIS analysis was used for this purpose. Note that although field survey of all Upland Swamps was undertaken to verify swamp vegetation, there are no relevant criteria to assist in swamp classification as headwater or valley in-fill based on field inspection.

The GIS analysis was completed by Dr Ross Jenkins (Niche GIS Analyst), who has had significant experience with spatial modelling of upland swamps of the Woronora Plateau through work with the University of New England[1]. The GIS analysis entailed the following:

1. Detailed vegetation mapping was completed using field verification, LiDAR and aerial imagery to map the boundary of the Upland Swamp TEC. The details associated with this process are provided in Section 4.3.1 of the BARBOS.
2. Each swamp boundary was then individually spatially assessed in terms of landscape position:
    a. The topographic location of swamps was determined by overlaying contour and hill shading GIS layers (i.e. swamp location within stream gully/valley).
    b. The position of the swamps in relation to mapped riparian areas was assessed (i.e. swamps were noted as being downstream/upstream of mapped watercourses), with the stream Strahler order noted.

The classification for each swamp is provided in Table D.02 of the Project Subsidence Assessment (MSEC, 2019), reproduced in Attachment A for reference.

[1] See: Jenkins R. B & Frazier P. S., 2010. *High-resolution remote sensing of upland swamp boundary and vegetation for baseline mapping and monitoring*. Wetlands 30, 531-540

Offset Properties

The descriptions of the proposed BOS within a) the EIS and BAR, b) the RTS and c) the Amendment Report (AR) vary significantly; particularly in respect of the proposed use of the existing Maddens Plains offset land to satisfy species credits for the two listed threatened frogs. In addition, the newly purchased offset property is estimated in the RTS as providing >90% of the Project's swamp offset requirement (289 of 305 credits required under the FBA calculation) but this has reduced to c. 39% (96 of 196 credits required under the BAM) in the AR.

Response:

Maddens Plains

The Maddens Plains Strategic Biodiversity Offset Site will not be used to generate additional offset credits for the Project, including for threatened frog species.

Note the Maddens Plains Strategic Biodiversity Offset site already offsets approved impacts to swamp Den02. The Project would relinquish approval to impact Den02 (0.7 ha) and, therefore, the net area of Upland Swamp to be offset for the Project is 20.9 ha (i.e. 21.6 ha minus 0.7 ha).

Monitoring of swamp Den02 will continue to be undertaken to confirm that greater than negligible environmental consequences has not occurred (in accordance with the Swamp Offset Policy). South32 would accept a condition in any consent for the Project that requires that if greater than negligible environmental consequences occur at Den02 due to subsidence-related effects from either the Project or cumulatively as a result of mining in other Dendrobium areas, an additional 0.7 ha of HN560 would be offset at the credit ratio specified in Table 2 below (i.e. 13.9 **B**BAM credits per hectare = approximately 10 **B**BAM credits total).

Additional offset for species credits associated with greater than negligible impacts at swamp Den02 is not relevant, as the Project offset liability for threatened species did not account for the relinquishment of Den02.

Offset Property

The Offset Property purchased by South32 following lodgement of the Project EIS may be secured under a Stewardship Agreement to satisfy a portion of the Project's offset liability (species and ecosystem credits), in particular Upland Swamp TEC requirements.

Initial calculations of the Upland Swamp TEC credits potentially generated by the Offset Property were undertaken using the NSW BioBanking Assessment Method (**B**BAM) calculator under the Framework for Biodiversity Assessment (FBA) as presented in the Submissions Report (i.e. estimated to provide 289 **B**BAM credits of 305 **B**BAM credits required).

The reasonable equivalence of the Project Upland Swamp offset liability under the Biodiversity Assessment Method (BAM) (i.e. conversion from FBA to BAM credits) has been estimated as 196 BAM credits (refer to Attachment B for methodology).

The current version (as at 1 October 2020) of the BAM offset calculator indicates 398 ecosystem credits (for HN560 and HN662) would be generated by the 51.3 ha of Upland Swamp TEC located on the Offset Property. The output of the BAM offset calculator is provided as Attachment C.

This value (398 credits) differs from the previous run of the BAM offset calculator (i.e. this letter supersedes the letter dated 8 September 2020), and we understand the difference in credits likely to be generated by the Offset Property is due to recent updates to the offset calculator by the Biodiversity and Conservation Division of DPIE.

Table 1 summarises the available Upland Swamp TEC credits determined under each assessment methodology. Figure 1 illustrates the key steps in the credit calculation process, including conversion from FBA to BAM credits.

Table 1: Swamp Offset Liability and Offset Property Credits under the FBA and BAM

Method	Swamp Offset Liability	Offset Property Swamp Credits	% of Offset Liability Satisfied by Offset Property
FBA	305 **B**BAM credits[#]	289 **B**BAM credits[#]	95%
BAM	196 BAM credits*	398 BAM credits^	203%

[#] *As per Niche (2019).*

** Reasonable equivalence of credits (i.e. conversion from FBA to BAM credits) is detailed in Attachment B.*

^ Refer to Attachment C for Credit Summary Report (dated 1 October 2020).

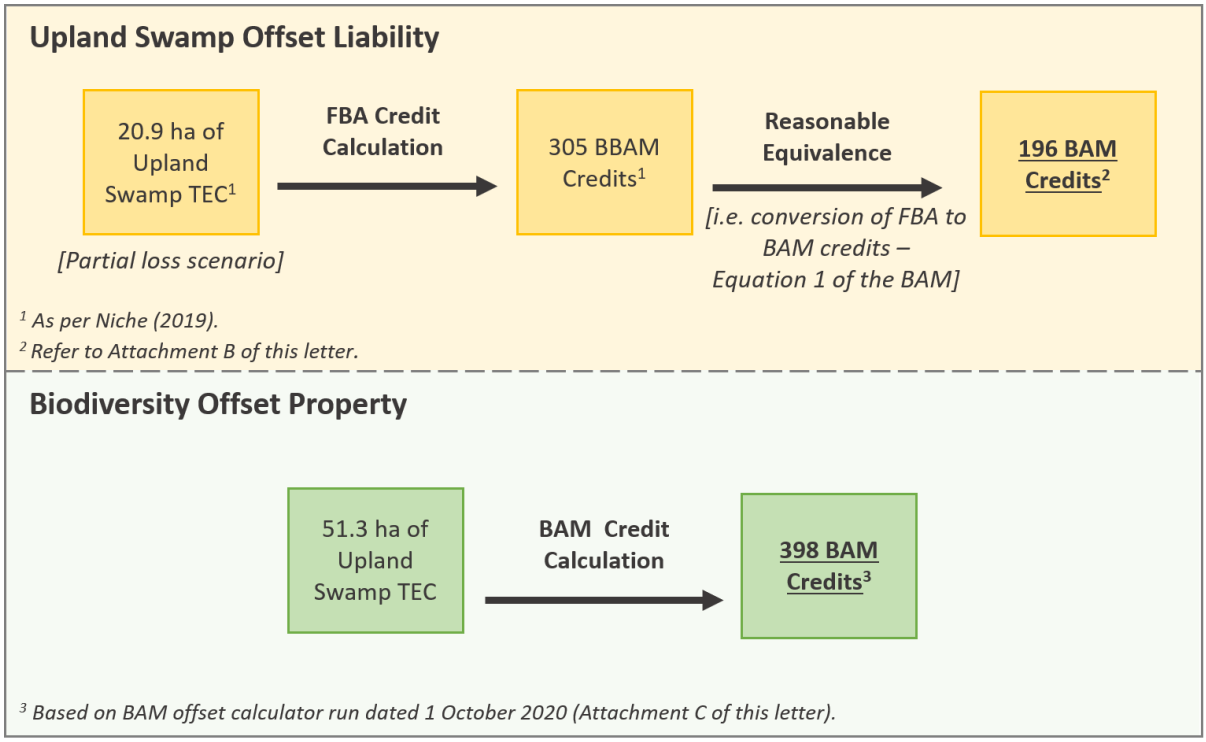


Figure 1: Upland Swamp TEC Offset Liability and Offset Property Credit Calculation

Note that although the total area of Upland Swamp TEC within the Offset Property (51.3 ha) remained unchanged for both credit calculations (FBA and BAM), the reasonable equivalence of the credits resulted in a change in the portion of the Upland Swamp offset liability estimated to be satisfied by the Offset Property.

South32 intends to apply for a Stewardship Agreement over the Offset Property and retire Upland Swamp TEC credits to account for 305 **B**BAM credits, calculated to be 'reasonably equivalent' to 196 BAM credits. This would satisfy both the NSW and Commonwealth offset liabilities under the amended Bilateral Agreement.

Offset Strategy

The AR contains no current statement of S32's proposed BOS nor the current policy requirements of the Commonwealth to satisfy its requirements in respect of offsets for upland swamps and threatened fauna (ie the two frogs). It is not clear from either the RTS or the AR whether the many options for the BOS discussed in the EIS and BAR remain live options or not.

Can I request that S32 provide P&A with a short document which sets out clearly:

a) *current policy settings constraining offset requirements, with particular reference to Commonwealth policy (NB I am comfortable with information previously provided in respect of State requirements, including wrt to upland swamps and Koalas);*

b) *current offset requirements, under both State and Cw legislation (NB I am comfortable with the information previously provided, but a simple table/s would enhance the value of the requested document); and*

c) *how these State and Cw offset requirements are proposed to be met. If a range of options are still possible, these should be clearly specified. (NB while I am comfortable with the information previously provided in the AR regarding proposed State offsets, it is not clear whether the range of mechanisms previously proposed in the EIS and BAR and RTS remain as potential options or whether they are now "off the table". This particularly relates to the indirect offsets proposed to remediate upland swamps, use of the Maddens Plains property for frog species offsets, etc).*

Response:

Biodiversity Offset Policy

The relevant biodiversity offset policy to the Project and calculation of the offset credit liability is the *NSW Biodiversity Offset Policy for Major Projects* (NSW Offset Policy) and supporting FBA, consistent with the Secretary's Environmental Assessment Requirements and the transitional provisions of the NSW *Biodiversity Conservation Act, 2016* (BC Act).

The calculation of a credit liability requirement for the Project has been undertaken using the FBA. However, the biodiversity offset liability for the Project would be satisfied by paying into the Biodiversity Conservation Fund and/or acquiring or retiring credits within the meaning of the BC Act. For example, species credits for threatened frog species could be generated by the Offset Property and the residual offset liability addressed by paying into the Biodiversity Conservation Fund.

Assessment of the Project offset liability under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) is under the Bilateral Agreement between New South Wales and the Commonwealth. On 24 March 2020, the Bilateral Agreement was amended to endorse the NSW Biodiversity Offsets Scheme (a component of the BC Act), which includes the BAM and the ability to satisfy Commonwealth offset liabilities by paying into the Biodiversity Conservation Fund and/or acquiring or retiring credits within the meaning of the BC Act.

The amended Bilateral Agreement allows South32 to pay into the Biodiversity Conservation Fund (administered by the Biodiversity Conservation Trust) to satisfy offset requirements for impacted threatened species and vegetation listed under the EPBC Act (and BC Act). Payment into the Biodiversity Conservation Fund to satisfy the Commonwealth offset liability was not previously available as an offset mechanism for South32. The Biodiversity Conservation Trust is required to meet the Commonwealth offset requirement component in a like-for-like manner.

Remediation of Upland Swamps has not been considered further as, following the calculation of offset credits provided by the Offset Property on 1 October 2020 (Attachment C), the Offset Property provides sufficient credits to satisfy the Upland Swamp offset liability.

Offset Liability and Offset Strategy

The Project biodiversity offset liability and proposed offset strategy is detailed in Tables 2 and 3 below (as per Tables 6 and 7 of the Amendment Report).

South32 would accept Development Consent conditions that require Project credit requirements (calculated in accordance with the FBA consistent with Tables 2 and 3 below) to be retired within the meaning of the BC Act and staged as below:

1. **Native vegetation disturbance** (i.e. surface disturbance) – credit liability calculated using the credit/ha ratios in Tables 2 and 3 for each Mining Operations Plan (or equivalent) that includes surface disturbance of native vegetation, with retirement of credits within 1 year of approval of the relevant Mining Operations Plan (or earlier).
2. **Subsidence** (excluding swamps) – credit liability calculated using the credit/ha ratios in Tables 2 and 3 for each Extraction Plan, with retirement of credits within 1 year of approval of the relevant Extraction Plan (or earlier).
3. **Upland Swamps** – swamp offset liability (based on a partial loss scenario) to be satisfied early in the Project life by applying for a Stewardship Agreement over the South32-owned Offset Property and retiring credits to account for 305 **B**BAM credits, calculated to be 'reasonably equivalent' to 196 BAM credits.

Previous Offset Considerations

Section 6.9.6 of the Project EIS provided that the following options were available to South32 to address NSW and Commonwealth offset liability:

1. *Retirement of FBA credits through existing South32 BioBank sites* [e.g. Appin West, Douglas Park and Cataract River BioBank Sites].
2. *Establishment of Stewardship sites on South32 landholdings and/or privately-owned property* [e.g. eastern portion of Illawarra Escarpment, Maddens Plains Strategic Offset, Project Offset Property].
3. *Other direct offset options – rehabilitation.*
4. *Payment into the Biodiversity Conservation Trust (BCT) Payment Fund.*
5. *Other direct or supplementary measures* [e.g. remediation of swamps].

Options 1, 2 and 4 remain available to South32 to satisfy the Project offset liability. However, the use of existing South32 BioBank sites is subject to the reasonable equivalence conversion process between **B**BAM and BAM credits.

Rehabilitation as an offset (Option 3) is not proposed and other direct or supplementary measures (Option 5) (e.g. remediation of swamps) are unlikely to be required. The use of Maddens Plains to generate additional threatened species offset credits is also no longer proposed.

The final Project Offset Strategy remains subject to detailed cost benefit analysis by South32 post-determination, in particular payment to the Biodiversity Conservation Fund versus identifying and securing additional offset properties.

References:

Mine Subsidence Engineering Consultants (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Subsidence Impact Assessment.*

Niche Environment and Heritage (2019). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Biodiversity Assessment Report and Bioiversity Offset Strategy*.

Niche Environment and Heritage (2020). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Supplementary Biodiversity Assessment Report.*

NSW Office of Environment and Heritage (2012). *Upland Swamp Environmental Assessment Guidelines – Guidance for the underground mining industry operating in the Southern Coalfield.*

Table 2: Project Ecosystem Credit Requirements and Offset Strategy (After: Niche, 2020)

Impact Mechanism		Vegetation Community		Area Impacted (ha)	Ecosystem Credits Required	Credits per hectare	Offset Strategy
Native Vegetation Disturbance	Ventilation shaft sites and ETL alignment	HN566	1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (PCT 1083)	26.9	1,051	39.1	Payment into the Biodiversity Conservation Fund and/or acquiring or retiring credits within the meaning of the BC Act, within 1 year of approval of the relevant Mining Operations Plan (or earlier).
		HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395)	0.55	40	72.7	
		HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250)	0.85	68	80.0	
	Pit Top Carpark Extension	HN597	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (PCT 1245)	0.2	6	30.0	
Subsidence	Upland Swamps	HN560	Needlebush - Banksia wet heath on sandstone plateau of the Sydney Basin Bioregion (PCT 978)	16.3	227	13.9	Within 1 year of the commencement of the Project, form a Stewardship Agreement over the Offset Property (and retire credits related to HN560* and HN662).
		HN662	Needlebush - Banksia wet heath swamps on coastal sandstone plateaus of the Sydney Basin (PCT 1804)	4.6	78	17.0	

* South32 would accept a condition that requires that if monitoring of Den02 confirms greater than negligible environmental consequences (in accordance with the Swamp Offset Policy) has occurred due to subsidence-related effects from either the Project or cumulatively as a result of mining in other Dendrobium areas, an additional 0.7 ha of HN560 would be offset at the credit ratio specified in Table 2 above (i.e. 13.9 **B**BAM credits per hectare = approximately 10 **B**BAM credits total).

Table 3: Project Species Credit Requirements and Offset Strategy (After: Niche, 2020)

Impact Mechanism		Threatened Fauna Species	Area Impacted (ha)	Species Credits Required	Credits per hectare	Offset Strategy
Subsidence	Streams and Upland Swamps	Giant Burrowing Frog (*Heleioporus australiacus*)	32.74	426	13.0	Payment into the Biodiversity Conservation Fund and/or acquiring or retiring credits within the meaning of the BC Act, within 1 year of approval of the relevant Mining Operations Plan (native vegetation disturbance) or Extraction Plan (subsidence) (or earlier).
		Littlejohn's Tree Frog (*Litoria littlejohni*)	32.74	851	26.0	
	Cliff lines	Broad-headed Snake (*Hoplocephalus bungaroides*)	0.28	9	32.1	
	Upland Swamps (breeding / foraging habitat)	Giant Dragonfly (*Petalura gigantea*)	13.93	1073	77.0	
	Streams	Red-crowned Toadlet (*Pseudophryne australis*)	7.21	94	13.0	
Native Vegetation Disturbance	Pit Top Carpark Extension and ETL alignment	Koala (*Phascolarctos cinereus*)	1.51	39	25.8	
	Pit Top Carpark Extension, ventilation shaft sites and ETL alignment	Eastern Pygmy-possum (*Cercartetus nanus*)	27.25	545	20.0	
	Ventilation shaft sites and ETL alignment	Rosenberg's Goanna (*Varanus rosenbergi*)	27.05	893	33.0	

ATTACHMENT A

TABLE D.02 OF PROJECT SUBSIDENCE ASSESSMENT (MSEC, 2019)

Table D.02 - Details and maximum predicted subsidence parameters for the swamps within the Study Area

Area	Swamp Ref.	Centroid Easting (MGA)	Centroid Northing (MGA)	Type	Location above or outside of longwalls	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)	Valley Height (m)	Maximum predicted total valley related upsidence (mm)	Maximum predicted total valley related closure (mm)	Maximum predicted total conventional closure (mm)
Area 5	Den01b	288160	6194155	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	5	< 20	20	< 20
	Den02	289445	6195065	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	30	50	90	< 20
	Den85	288110	6194985	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	5 to 15	30	40	< 20
	Den86	286550	6196490	Headwater	Above	1600	14	0.25	0.40	5 to 15	225	250	225
	Den97	286870	6197535	Headwater	Above	1350	9	0.13	0.17	5 to 15	200	200	90
	Den98	289265	6196420	Valley Infill	Outside	1450	19	0.40	0.40	30	400	575	200
	Den99	285210	6196095	Headwater	Above	1650	14	0.30	0.40	5 to 10	200	200	100
	Den100	286770	6197040	Headwater	Above	1050	12	0.25	0.04	0 to 5	80	90	125
	Den101	285930	6196350	Headwater	Above	1750	15	0.30	0.40	5	80	80	< 20
	Den102	286030	6196530	Headwater	Above	1400	10	0.15	0.13	No valley	-	-	-
	Den103	285860	6196715	Headwater	Above	1700	17	0.30	0.40	10 to 15	150	225	< 20
	Den104	285405	6196865	Valley Infill	Above	80	4	0.08	< 0.01	20	275	300	< 20
	Den105	285305	6196775	Headwater	Above	1150	19	0.30	0.40	No valley	-	-	-
	Den106	287455	6195075	Headwater	Outside	1250	13	0.20	0.30	No valley	-	-	-
	Den107	286325	6195175	Headwater	Above	1450	15	0.09	0.35	5 to 10	175	175	125
	Den108	286595	6195135	Valley Infill	Above	1450	15	0.30	0.40	20 to 25	525	525	150
	Den109	286285	6195730	Headwater	Above	900	7	0.18	0.04	10 to 15	225	250	60
	Den110	285875	6195785	Headwater	Above	1150	11	0.25	0.06	5 to 10	125	125	70
	Den111	285950	6195580	Valley Infill	Above	1750	9	0.13	0.40	15 to 20	325	325	70
	Den114	285235	6195590	Headwater	Above	1600	10	0.15	0.18	15 to 20	300	325	< 20
	Den120	287035	6197320	Headwater	Above	1400	12	0.20	0.30	5	70	70	150
	Den121	284605	6196505	Valley Infill	Above	1500	15	0.30	0.35	15 to 30	400	425	275
	Den122	284895	6196585	Headwater	Above	1300	10	0.19	0.07	5 to 15	225	225	150
	Den123	285670	6196275	Headwater	Above	1750	11	0.16	0.19	No valley	-	-	-
	Den124	289600	6196090	Valley Infill	Outside	< 20	< 0.5	< 0.01	< 0.01	35 to 40	125	325	< 20
	Den126	288035	6197970	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
	Den127	290080	6197250	Valley Infill	Outside	< 20	< 0.5	< 0.01	< 0.01	5 to 10	< 20	< 20	< 20
	Den137	286970	6198190	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
Area 6	Den83	291320	6201095	Headwater/Valley Infill	Above	2300	17	0.20	0.45	20	275	275	50
	Den112	292190	6200770	Headwater	Outside	50	1	0.02	< 0.01	5 to 10	20	30	< 20
	Den113	291670	6200320	Headwater	Above	2250	18	0.20	0.45	10 to 20	350	350	200
	Den115	291625	6198750	Headwater	Outside	30	< 0.5	0.02	< 0.01	5 to 10	30	30	< 20
	Den116	292085	6199195	Headwater	Outside	100	2	0.03	< 0.01	5 to 25	100	100	< 20
	Den117	291650	6199855	Headwater	Above	2250	15	0.20	0.45	10 to 15	250	300	150
	Den118	291040	6201585	Valley Infill	Above	1250	13	0.18	0.25	20	175	175	50
	Den119	290480	6201905	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	5 to 10	< 20	30	< 20
	Den128	291260	6201850	Headwater	Above	20	< 0.5	0.01	< 0.01	5 to 10	40	40	< 20
	Den129	292290	6201480	Valley Infill	Outside	< 20	< 0.5	< 0.01	< 0.01	5 to 20	30	40	< 20
	Den130	292705	6201170	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
	Den131	292235	6198560	Valley Infill	Outside	< 20	< 0.5	< 0.01	< 0.01	10 to 25	60	90	< 20
	Den132	292960	6198975	Valley Infill	Outside	< 20	< 0.5	< 0.01	< 0.01	5 to 20	< 20	20	< 20
	Den133	291750	6202320	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
	Den134	290755	6202070	Valley Infill	Outside	< 20	< 0.5	< 0.01	< 0.01	5 to 10	< 20	20	< 20
	Den135	291355	6202310	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
	Den136	291650	6202120	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
	Den138	292725	6200860	Headwater	Outside	< 20	< 0.5	< 0.01	< 0.01	No valley	-	-	-
					Maximum	**2300**	**19**	**0.40**	**0.45**		**525**	**575**	**275**

ATTACHMENT B

REASONABLE EQUIVALENCE CREDIT CALCULATION

Table B-1: Upland Swamp Offset Liability and Reasonable Equivalence Calculation

Summary of Upland Swamp Offset Liability	
Upland Swamp Offset Liability	• 20.9 ha of Upland Swamp TEC within 60 m of proposed longwalls predicted to be "partially impacted" by the Project (i.e. 21.6 ha minus 0.7 ha of Den02, a swamp approved to be impacted by the Dendrobium Mine which has been explicitly offset, with approval to impact this swamp to be relinquished for the Project). • This equates to an offset liability of 305 **B**BAM credits under the Biobanking Credit Calculator, comprising 227 **B**BAM credits for HN560 and 78 **B**BAM credits for HN662.
Reasonable Equivalence	• Reasonable equivalence of credits (i.e. conversion from FBA to BAM credits) has been estimated using Equation 1 of the BAM, applying changes in site value scores as determined in Table 55 of the BARBOS (11.59 for HN560 and 15.75 for HN662) and assuming a biodiversity risk weighting of 3. • This equates to an equivalent total offset liability of 196 BAM credits. **Equation 1: Determine the number of ecosystem credits required for the impact on vegetation that is a TEC or contains threatened species habitat** $$\text{Ecosystem credits required for each vegetation zone} = \sum_{i=1}^{n} (\Delta\text{VI Loss} \times BRW \; x \; area) \; x \; 0.25$$ *where:* *i = the i^{th} vegetation zone impacted by development at the development site, or on land to be biodiversity certified* *ΔVI Loss = the change (loss) in the vegetation integrity score of a vegetation zone at the development site as determined by Equation 19* *BRW = means the biodiversity risk weighting applied to the vegetation zone. The biodiversity risk weighting for a TEC or a PCT containing threatened species habitat is based on the sensitivity to loss class of the TEC/PCT and the highest sensitivity to gain class of the predicted threatened species. For a PCT or TEC not associated with threatened species habitat, the sensitivity to loss class for the PCT or TEC is used with the low sensitivity gain class* *area = the area in hectares of the vegetation zone*

ATTACHMENT C

BAM CREDIT SUMMARY REPORT - STEWARDSHIP AGREEMENT
(1 OCTOBER 2020)

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id
00018181/BAAS17033/19/00018182

Proposal Name
3365 Lloyd Preliminary

BAM data last updated *
20/08/2020

Assessor Name

Report Created
01/10/2020

BAM Data version *
30

Assessor Number

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Stewardship (for offset sites)

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion					
1	978_Restiod	31.6	49.2	0.25	389
2	978_TeatreeThicket	9.1	1.4	0.25	3

3	978_Restiod_trees	29.4	0.8	0.25	6
				Subtotal	**398**
				Total	**398**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits