

3 July 2020

Stephen O'Donoghue
Director Resource Assessments
Department of Planning, Industry and Environment
12 Darcy Street
Parramatta NSW 2124

Illawarra Coal
South32
Innovation Campus
Enterprise 1 Bldg. Level 3 Squires Way
NORTH WOLLONGONG NSW 2500
PO Box 514
UNANDERRA NSW 2526
T +61 2 4286 3000
south32.net

via email: Stephen.ODonoghue@planning.nsw.gov.au

Dear Stephen,

RE: DENDROBIUM MINE – RESPONSES TO BIODIVERSITY AND CONSERVATION DIVISION

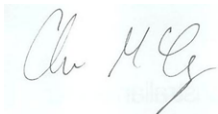
In response to DPIE's letter dated 20 April 2020, please find below and enclosed South32's responses to residual comments made by the Biodiversity and Conservation Division (BCD) in its submission on the *Dendrobium Mine – Plan for the Future: Coal for Steelmaking EIS* (the Project) and associated Submissions Report, dated 9 March 2020.

South32 has previously outlined its commitments and assessment in regard to offsetting potential impacts to biodiversity in the EIS and the Submissions Report. The purpose of this letter and its enclosures is to provide further detail in regard to South32's assessment of impacts to biodiversity and determination of offset requirements in response to the concerns raised by BCD in its additional submission.

Responses to the BCD's key comments are provided below, and detailed responses to the advice provided in Attachment A of the BCD's submission is provided in Enclosure 1.

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

Comment: *There is no change to the proposed mining layout which was presented in the EIS. The RTS comprises limited discussion of alternate mining geometry layouts and extraction methods. However, such alternatives are not outlined in any detail or with transparency. Further detailed evidence regarding alternative layouts, extraction method or measures taken to avoid impacts needed to be presented.*

Multiple alternative mine plans have been considered in the EIS and the Submissions Report during the development of the Project layout. In summary:

- The proposed Project layout setbacks from dam walls, dam full supply levels, named watercourses and key stream features result in the sterilisation of approximately 25 million tonnes (Mt) of run-of-mine (ROM) coal within South32's existing mining tenement (Consolidated Coal Lease [CCL] 768) (adjacent to Area 5), worth some \$3.58 billion and \$222 million in associated royalties.
- A longwall layout that avoids undermining Upland Swamps was considered in the EIS (i.e. the 'minimum case'). This longwall layout is not considered to be reasonable given the significant additional resource sterilisation (21.2 Mt of ROM coal, worth some \$3 billion and \$186 million in associated royalties) and reduction in net benefits to NSW of approximately \$220 million in net present value (NPV) terms relative to the Project.
- Narrower panels would result in the potential for a reduction in subsidence-related impacts (MSEC, 2019a), however, 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 NSW.

Comment: *Accordingly, we maintain that the proposal does not sufficiently demonstrate that the "avoid" principle has been met, having regard to biodiversity assessment policy, guidelines and the SEARs, as per our EIS submission. In its current form the proposal is almost certain to have a significant impact on NSW and Commonwealth-listed water-dependent threatened species and ecological communities. The proposed longwall mining layout remains and the resultant associated subsidence will lead to adverse impacts to all tributaries and associated ecosystems that are adjacent or above.*

As described above, the Project layout sets back from various natural and built features. In addition, the Project has considered the following to avoid potential impacts to Upland Swamps:

- The selection of proposed mining in Areas 5 and 6 as opposed to Area 4 (which is located within South32's existing CCL 768) (Figure 1).
- Surface infrastructure has been located to avoid direct impacts to Upland Swamps.
- The implementation of the mine constraints for the Project would result in avoidance of directly undermining a number of Upland Swamps including Den124, Den115, Den131, Den132, Den119 and Den134.
- Alternative longwall geometry/methods within Areas 5 and 6 have been considered, however, potential impacts to Upland Swamps are still expected for alternative longwall layouts (i.e. as subsidence impacts will still occur at 150 metre [m] wide panels) (MSEC, 2019a).

Accordingly, it is considered that reasonable avoidance measures have already been incorporated into the Project design, with residual impacts associated with the Project to be offset in accordance with Government policy.

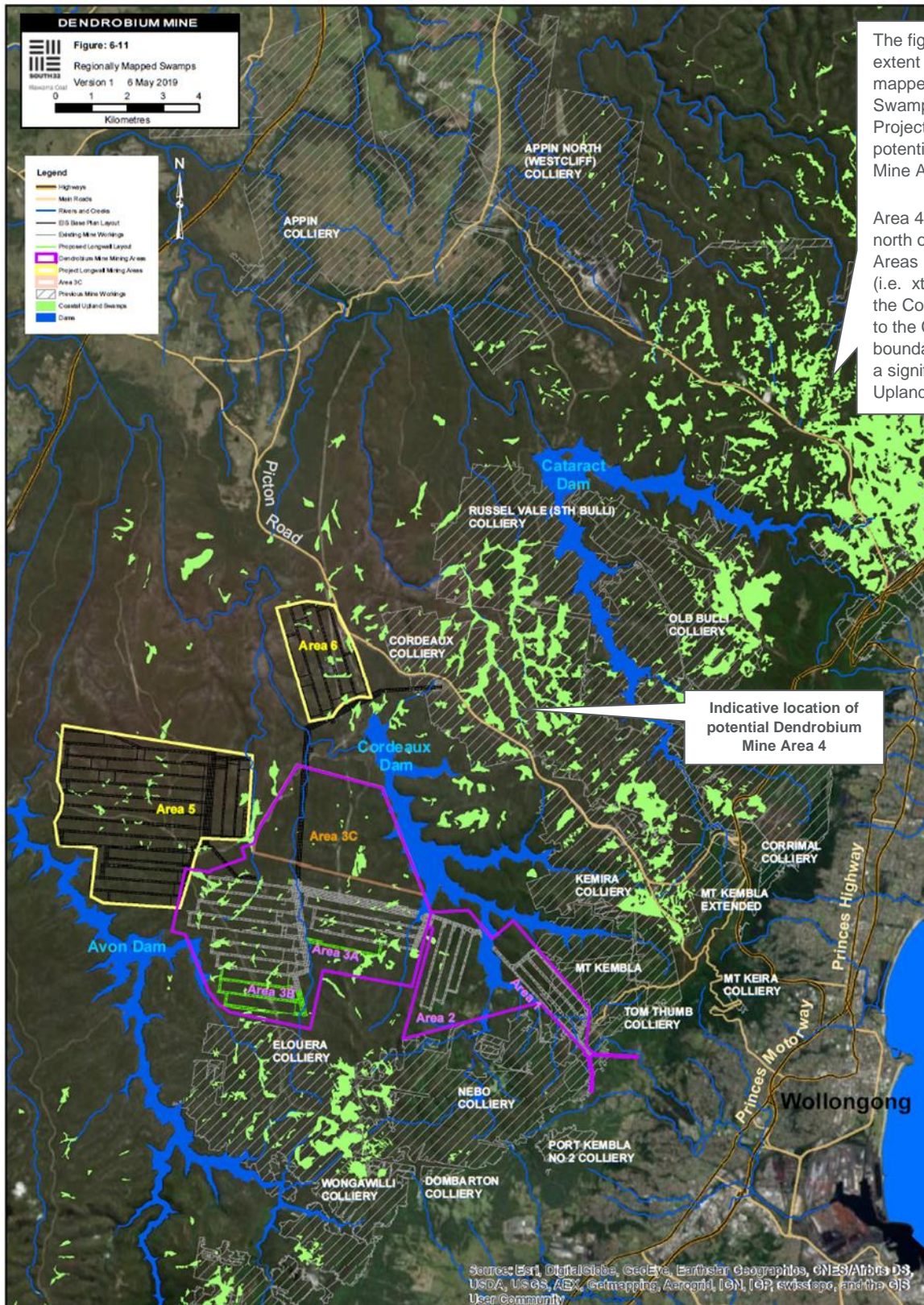


Figure 1: Regionally Mapped Swamps

The Biodiversity Assessment Report and Biodiversity Offset Strategy (BARBOS) (Niche, 2019) for the EIS described that there was the potential for a significant impact to threatened ecological communities associated with Upland Swamps and water-dependent threatened species due to subsidence-related impacts from the Project. Accordingly, subsidence-related impacts to these threatened communities/species are proposed to be offset as follows:

- Residual potential impacts to Upland Swamps would be offset as per the Swamp Offset Policy.
- Residual potential impacts to relevant threatened species with habitat that may be potentially affected by reductions in stream flow and/or impacts to swamps due to subsidence-related impacts from the Project would be offset in accordance with Government policy (relevant to the Giant Burrowing Frog, Littlejohn's Tree Frog, Giant Dragonfly and the Red-crowned Toadlet).

Comment: *The FBA and Coastal Upland Swamp Offset Policy has been incorrectly applied in calculating the maximum predicted offset liability for Coastal Upland Swamps, and as a result the offset liability for Coastal Upland Swamp has been significantly under-estimated. The Upland Swamp Offset Policy requires calculation against a 'worst-case scenario' equating to total loss of swamps. This needed to be reflected in the applicant's approach.*

The offset credit liability for Upland Swamps has been estimated as follows:

- 21.6 hectares (ha) of Upland Swamps (comprising vegetation communities HN 560 and HN 556) within 60 m of the Project longwalls have been assessed as being likely to experience 'greater than negligible environmental consequences' due to potential changes in swamp hydrology.
 - This is based on review of Upland Swamp shallow piezometer data from Dendrobium Mine Areas 2, 3A and 3B by Watershed HydroGeo (2019), which concluded that changes in swamp hydrology were not observed at distances greater than 60 m from the previously mined Dendrobium Mine longwalls.
- Approved impacts to 0.7 ha of Upland Swamp associated with Den02 have already explicitly been offset for the approved Dendrobium Mine (Figure 2).
 - The approval to impact Den02 would be relinquished for the Project.
 - Accordingly, a net increase of 20.9 ha (i.e. 21.6 ha minus 0.7 ha) of Upland Swamps within 60 m of the Project longwalls would potentially be impacted for the Project (refer to Table 33 of Niche [2019]).
- The credit liability associated with subsidence-related impacts to this 20.9 ha of Upland Swamps was calculated using the BioBanking Credit Calculator (BBCC) (version 4.0) by Accredited Assessors (Niche, 2019).
 - The BBCC Operational Manual provides that site value scores may reflect a transition of vegetation types, rather than complete clearing:

You can adjust the scores in the Score with development (0–3) column for each of the 10 attributes, based on the condition of the vegetation after development. If the site is to be completely cleared, retain all scores at zero. However, if the management zone is only going to be thinned or partially impacted (such as for an APZ), the score for each site attribute should be amended to a more appropriate level.

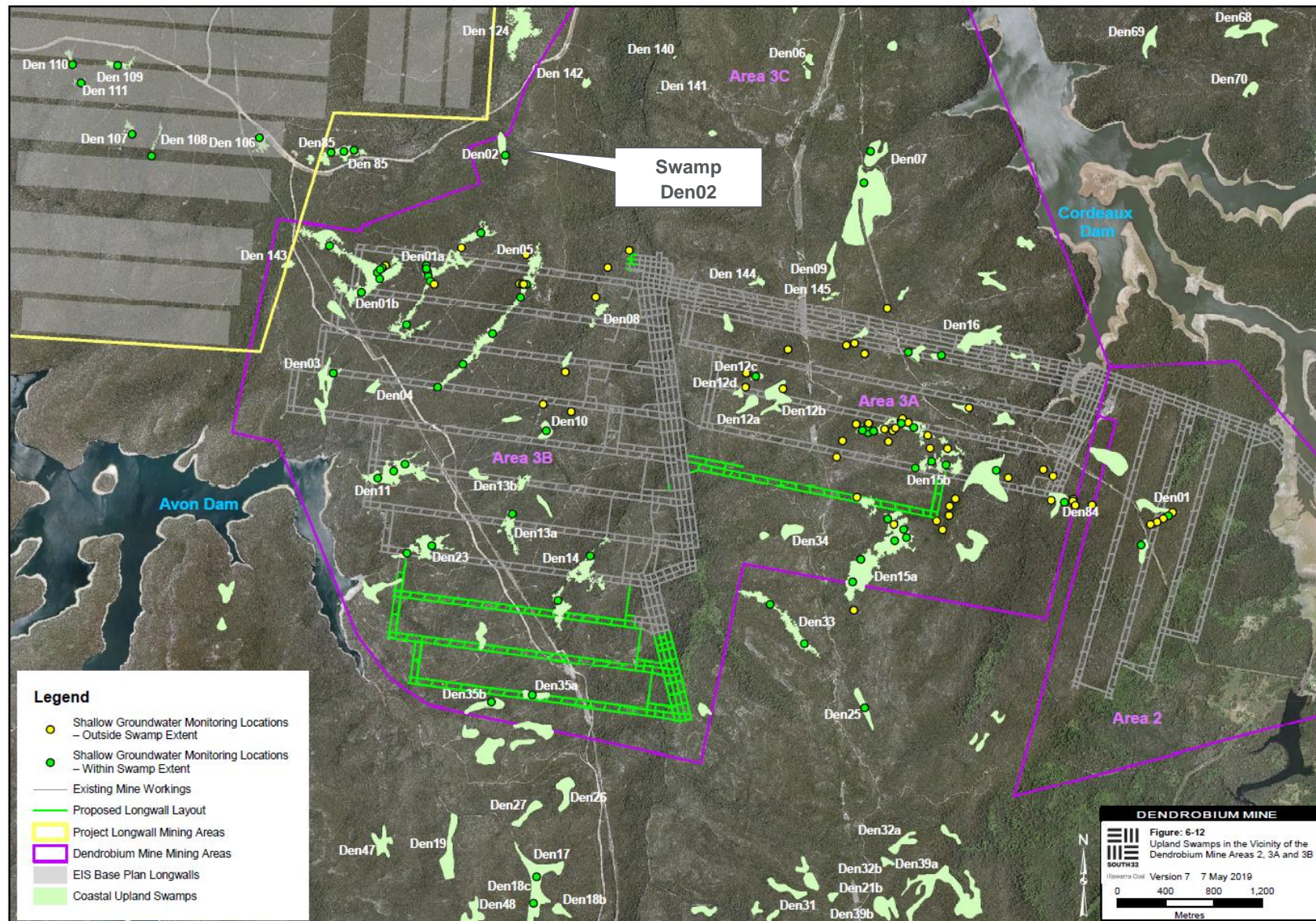


Figure 2: Location of Swamp Den02

- Based on the results of extensive monitoring data from previously undermined Upland Swamps, site values used in the BBCC reflected a ‘partial impact’ based on the extensive data record showing the persistence of native vegetation (albeit with some change of composition) and habitat within the swamps (refer to Table 55 of Niche [2019] for details of the BBCC inputs). Note that Niche (2019) states:

Whilst South32 acknowledges that a groundwater change may be experienced in Coastal Upland Swamps in the Study Area, there is strong evidence that indicates native vegetation and fauna habitat would still persist following mining, in fact there is little evidence to the contrary...

- Accordingly, the resultant ecosystem credit liability assuming ‘partial impact’ of undermined Upland Swamps is 227 ecosystem credits for HN 560 and 78 ecosystem credits for HN 556. If a ‘total impact’ scenario was assumed, then resultant ecosystem credit liability for HN 560 and HN 556 would be greater.
- However, it should be noted that for threatened species with habitat comprising Upland Swamps, the relevant species credit liability has been calculated based on a ‘total impact’ scenario for the relevant habitat (relevant to the Giant Burrowing Frog, Littlejohn’s Treefrog and Giant Dragonfly).

Comment: *We note that the offset strategy has been updated to demonstrate that a significant proportion of Coastal Upland Swamp offset liability (>90%) can, according to the proponent’s calculations, be achieved along with other threatened species credits required to offset the project. However, as noted above, we maintain there are significant shortcomings with the application of the FBA to calculate the swamp offset requirement. This means that the offset liability for this threatened ecological community has been significantly under-estimated, and therefore not satisfactory in that the proposed offset package including the additional site would not meet the offset requirements.*

If the Project were conditioned with an Upland Swamp ecosystem credit liability reflecting a ‘partial impact’ scenario, then Upland Swamp water level monitoring (including shallow piezometers and soil moisture probes) and vegetation monitoring for swamps within 400 m of the proposed longwalls would be undertaken to confirm actual impacts. If monitoring undertaken indicates impacts greater or less than those predicted following undermining, the ultimate offset liability would be increased or decreased accordingly.

The landholding (the Offset Property) secured by South32 may be used to satisfy a portion of the Project’s offset liability associated with Upland Swamps. Any residual credit requirements would be satisfied using the available mechanisms under the BC Act and NSW Offset Policy including:

- payment into the Biodiversity Conservation Trust (BCT) Payment Fund; and/or
- other direct or supplementary measures.

Comment: *The proposal to fund research programs within the Dharawal NPWS reserves is not an appropriate approach to meeting obligations for direct offsets, particularly with regard to Coastal Upland Swamps. Successful rehabilitation proposals relate to rehabilitation from the impacts of previous land uses only. Undermined swamps impacted by a significant fire event are extremely likely to be desiccated and incapable of rehabilitation, as informed by recent site visits to impacted swamps on the Newnes Plateau (Attachment B). Furthermore, supplementary measures such as management actions are only to be used in lieu of offsets as a last resort only, as per the NSW Biodiversity Offset Policy for Major Projects.*

There are a number of Upland Swamps on the Illawarra Escarpment that have been disturbed by previous land uses, including clearance for access tracks and electricity transmission lines.

If South32 implemented or funded additional remediation and rehabilitation measures for previously disturbed Upland Swamps within the Dharawal Reserves or other areas (in coordination with NPWS or the relevant landowner), it would provide a material increase in biodiversity values that could contribute to the Project's biodiversity offset strategy.

As noted by the BCD, rehabilitation of swamps impacted by previous land uses (i.e. clearing) have been successful. The Submissions Report also provides examples of successful remediation of previously disturbed swamps.

Comment: *The RTS notes that the Maddens Plains Strategic Biodiversity site, set aside as an offset for earlier major projects, will continue to be investigated for threatened amphibian species credits. Our understanding is that further biodiversity offsets for new projects such as the Dendrobium Mine Extension are not available from the Maddens Plains site.*

The Maddens Plains Strategic Biodiversity site will not be used to generate additional offset credits for the Project.

Comment: *Issues remain with the FBA calculations for some threatened species, namely Koala, Powerful Owl and Eastern Pygmy Possum. Previous comments highlighted the inadequacy of assessment for areas where new surface infrastructure is proposed, and it is unclear why these have not been addressed.*

At the time of lodgement of the EIS, the locations of some surface infrastructure (service boreholes and electricity transmission lines) were not defined.

As per the approach approved for the Bulli Seam Operations, an allowance of 9.5 ha of native vegetation disturbance for this 'unfixed' infrastructure outside of delineated areas was described in Section 3.10.4 of the EIS (including an allowance of 1.5 ha of Shale Sandstone Transition Forest TEC) and assessed accordingly by Niche (2019) (Appendix D of the EIS). Offset ecosystem and species credit liabilities were calculated for this allowance of 9.5 ha based on assumed vegetation types to be impacted (including the 1.5 ha of TEC) and fauna habitat associated with these vegetation types.

Inclusive of this 9.5 ha of disturbance for 'unfixed' infrastructure, the total native vegetation disturbance for the Project in the EIS was 28.5 ha.

In response to comments from BCD, and following further design work for surface infrastructure, the locations of service boreholes and electricity transmission lines have now been delineated (i.e. 'fixed'), and additional ecology surveys conducted accordingly (Figures 3 and 4). This results in:

- **No change** in total disturbance of 28.5 ha (Table 1).
- A proposed increase to Ventilation Shaft Site 5A to accommodate service boreholes and other design refinements (with reduced disturbance requirements at Ventilation Shaft Site 5B and the previous allowance for service boreholes accordingly) (Table 1).
- **A reduction** of approximately 1 ha in proposed disturbance of Shale Sandstone Transition Forest TEC (PCT 1395) (Table 2).

- Revised offset credit liabilities for ecosystem and species credits (Tables 3 and 4), with the additional survey work confirming:
 - Increased species credit liabilities for the Eastern Pygmy-possum and Rosenberg's Goanna (Table 4).
 - Confirmation of the species credit liability for the Koala (Table 4).
 - Confirmation that potential impacts to the Powerful Owl would be offset by ecosystem credits for PCT 1395/HN 556.

Table 1: Revised Breakdown of Proposed Project Surface Disturbance

	Site	EIS – Area of Native Vegetation Disturbance (ha)	Revised – Area of Native Vegetation Disturbance (ha)	Change (ha)
'Fixed' Infrastructure (EIS)	Ventilation Shaft Site No 5A	7.5	15.0 (includes service boreholes – previously 'unfixed')	+7.5
	Ventilation Shaft Site No 5B	3.0	0.5	-2.5
	Ventilation Shaft Site No 6A	4.3	4.3	-
	Ventilation Shaft Site No 6B	4.0	4.0	-
	Pit Top Carpark Extension	0.2	0.2	-
'Unfixed' Infrastructure (EIS)	Additional Service Boreholes	5	0 (refer to Site 5A)	-5
	Electricity Transmission Lines (to Ventilation Shaft Sites)	4.5	4.5 (now 'fixed')	-
Total		28.5	28.5	-

Comment: *We maintain that the proposed longwall layout is likely to harm multiple Aboriginal cultural heritage sites, including a number of sites of high Aboriginal cultural and scientific significance, due to subsidence from undermining. Previous comments requested further clarity on Aboriginal community consultation and updates to the Aboriginal cultural heritage assessment so it is unclear why these have also not been addressed.*

It is not reasonable to avoid undermining all Aboriginal cultural heritage sites within Areas 5 and 6, noting that consideration of alternate mining layouts determined subsidence-related surface impacts would still occur for a mine plan with narrower longwall panels, and would adversely affect the economics of the Project. South32 will prepare an Aboriginal Heritage Management Plan in consultation with the RAPs, incorporating recommended management measures from the ACHA.

It is noted that only one site identified as having 'high' scientific significance would be directly undermined by the Project longwalls. The ACHA (Appendix F of the EIS) concluded that a structural change due to subsidence does not necessarily contribute to an adverse consequence to the heritage site. Only three of 61 undermined sandstone shelter sites in the existing Dendrobium Mine areas have been impacted by subsidence movements.

Table 2: Breakdown of Revised Native Vegetation Impacts (Source: Niche, 2020)

PCT Code	BVT Code	BVT Name	Updated Area of Impacted Native Vegetation (ha)								Change
			Ventilation Shaft Site No. 5A	Ventilation Shaft Site No. 5B	Ventilation Shaft Site No. 6A	Ventilation Shaft Site No. 6B	Pit Top Carpark Extension	Service Boreholes	ETL Alignment	Total	
1083	HN566	Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion	15.0	0.5	4.3	4.0	-	-	3.1	26.9	+1.1 ha
1395	HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*	-	-	-	-	-	-	0.55	0.55	-0.95 ha
1250	HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	-	-	-	-	-	-	0.85	0.85	-0.15 ha
1245	HN597	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	-	-	-	-	0.2	-	-	0.2	-
Total			15.0 ha	0.5 ha	4.3 ha	4.0 ha	0.2 ha	0.0 ha	4.5 ha	28.5 ha	-
Change (from EIS BARBOS)			+7.5 ha	-2.5 ha	-	-	-	-5.0 ha	-	-	

Note: Red text indicates the area of impact has increased, green text indicates the area of impact has reduced.

* Shale Sandstone Transition Forest TEC

Table 3: Updated Project Ecosystem Credit Requirements (Source: Niche, 2020)

Impact Mechanism		Vegetation Community		Project EIS		Updated in Response to BCD		Change in Credit Requirement
				Area Impacted (ha)	Ecosystem Credits Required	Area Impacted (ha)	Ecosystem Credits Required	
Surface Disturbance	Ventilation shaft sites and ETL alignment	HN566	1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (PCT 1083)	25.8	1,022	26.9	1,051	+29
		HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395)	1.5	120	0.55	40	-80
		HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250)	1.0	80	0.85	68	-12
	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	0.2	6	0
Subsidence	Upland Swamps	HN560	Needlebush - Banksia wet heath on sandstone plateau of the Sydney Basin Bioregion (PCT 978)	16.3	227	16.3	227	0
		HN556	Needlebush - Banksia wet heath swamps on coastal sandstone plateaus of the Sydney Basin (PCT 1804)	4.6	78	4.6	78	0

Table 4: Updated Project Species Credit Requirements (Source: Niche, 2020)

Impact Mechanism		Threatened Fauna Species	Project EIS		Updated in Response to BCD		Change in Credit Requirement
			Area Impacted (ha)	Species Credits Required	Area Impacted (ha)	Species Credits Required	
Subsidence	Streams and Upland Swamps	Giant Burrowing Frog (<i>Heleioporus australiacus</i>)	32.74	426	32.74	426	0
		Littlejohn's Tree Frog (<i>Litoria littlejohni</i>)	32.74	426	32.74	851	0
	Cliff lines	Broad-headed Snake (<i>Hoplocephalus bungaroides</i>)	0.28	9	0.28	9	0
	Upland Swamps (breeding/foraging habitat)	Giant Dragonfly (<i>Petalura gigantea</i>)	13.93	1073	13.93	1073	0
	Streams	Red-crowned Toadlet (<i>Pseudophryne australis</i>)	7.21	94	7.21	94	0
Surface Disturbance	Pit Top Carpark Extension and ETL alignment	Koala (<i>Phascolarctos cinereus</i>)	1.5	39	1.51	39	0
	Pit Top Carpark Extension, ventilation shaft sites and ETL alignment	Eastern Pygmy-possum (<i>Cercartetus nanus</i>)	n/a	n/a	27.25	545	+545
	Ventilation shaft sites and ETL alignment	Rosenberg's Goanna (<i>Varanus rosenbergi</i>)	n/a	n/a	27.05	893	+893

Note: Red text indicates the area of impact has increased, green text indicates the area of impact has reduced.

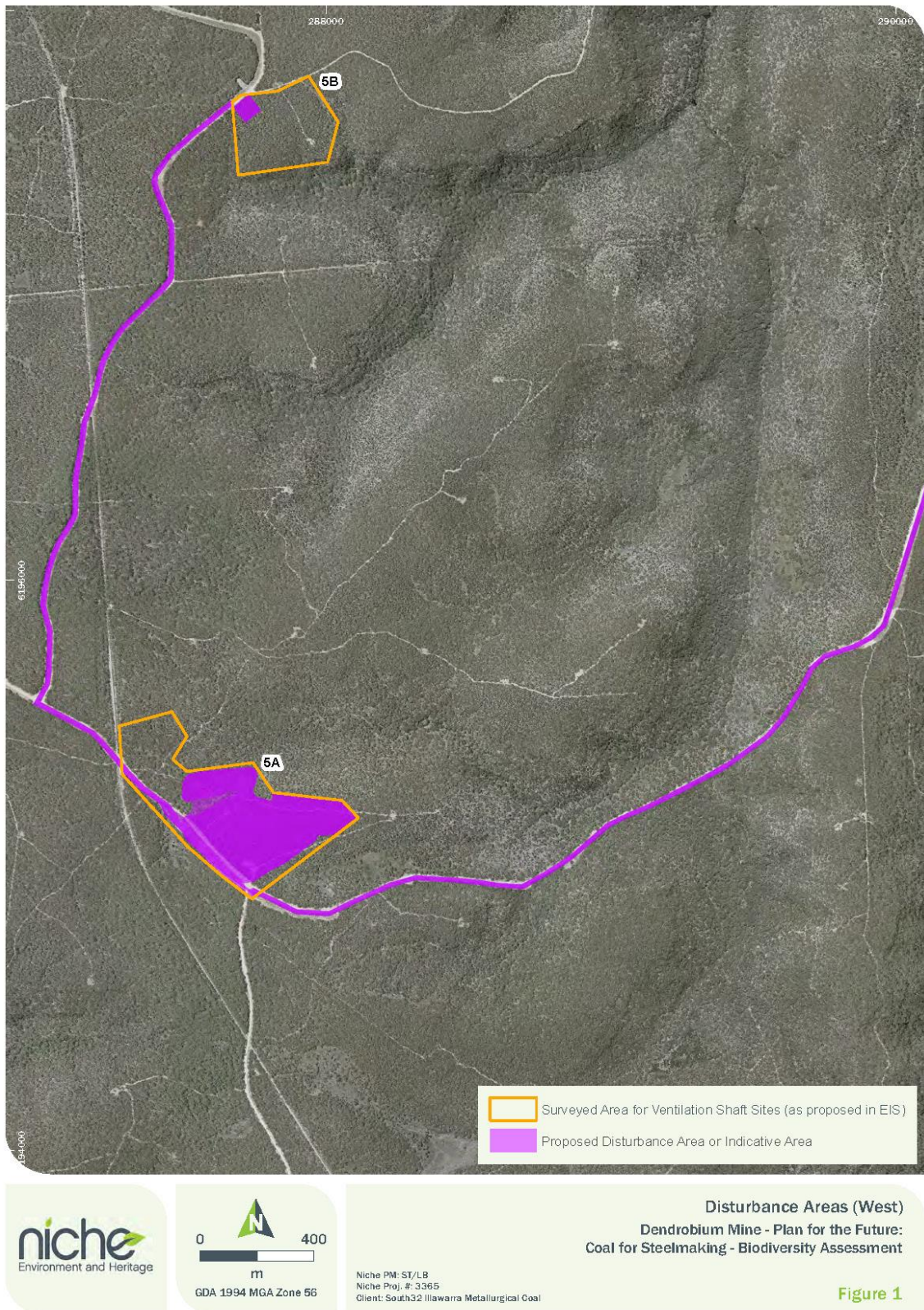


Figure 3: Proposed Surface Disturbance Area – West (Source: Niche, 2020)



Figure 4: Proposed Surface Disturbance Area – East (Source: Niche, 2020)

ENCLOSURE 1

RESPONSES TO BIODIVERSITY CONSERVATION DIVISION SUBMISSION

BIODIVERSITY AND CONSERVATION DIVISION

Introduction

Attachment A of the BCD submission, dated 9 March 2020, provided further comments on the Dendrobium Project Environmental Impact Statement (EIS) and Submissions Report. This enclosure provides responses to these comments, grouped by subject as follows:

- assessment of subsidence impacts, including demonstrating avoidance of habitat and associated performance measures (BCD Comments 1, 5, 11 and 12);
- review of hydrological modelling (BCD Comment 14);
- assessment of impacts to Coastal Upland Swamp Threatened Ecological Communities (TECs) (BCD Comments 2, 3, 4 and 13);
- assessment of impacts to native vegetation and threatened species from surface disturbance (BCD Comments 6, 7, 8 and 9); and
- further clarification of the Project Aboriginal Cultural Heritage Assessment (BCD Comments 15, 16, 17 and 18).

Comments 1, 5, 11 and 12 – Assessment of Subsidence Impacts

Comment 1: Avoidance of Impacts – proposed mining layout does not adequately demonstrate avoidance of impacts, particularly to Coastal Upland Swamp threatened ecological community and threatened frogs

BCD stated:

Avoidance of impacts could be achieved by not undermining swamps or by narrowing longwall panel widths to reduce subsidence effects below the surface cracking thresholds. No additional modelling of alternate longwall layouts or mining geometry (e.g. narrowed panels) or impact assessment for threatened species and communities has been completed or presented. There is limited discussion of alternate mining geometry or extraction methods at s6.5 of the RTS.

Although it is acknowledged that subsidence and related impacts would be reduced under alternate mine layouts and extraction methods (approximately 150m wide panels), these are dismissed as being not feasible on economic grounds but without evidence or ability to verify the claim. No further evidence or discussion analysing alternatives in further depth has been provided.

The proponent has not completed alternative assessment of impacts to streams using revised valley closure values. Ecological importance of un-named tributaries fails to consider presence of threatened frogs, which is a significant omission.

The proposed mine layout remains unchanged from the EIS. As such, we remain concerned that the EIS does not adequately demonstrate the “avoid” principle and significant impacts to a number of threatened entities, as listed under both NSW and Commonwealth legislation, are highly likely (this project uses the same mining geometry/methods as previous activities that have resulted in certain and irreversible impacts. As such, adverse impacts from this project are almost certain and proving irreversible).

South32 Response

Consideration of Avoidance of Upland Swamps and Watercourses

Upland Swamps

South32 does not agree with the BCD’s statement that the *Addendum to NSW Biodiversity Offsets Policy for Major Projects: Upland swamps impacted by longwall mining subsidence* (OEH, 2016) (the Swamp Offset Policy) “avoid principle” has not been considered, as the Project EIS considered a longwall layout that avoids undermining all Upland Swamps in Areas 5 and 6 (i.e. the ‘minimum case’).

However, this longwall layout is not considered to be reasonable given the significant additional resource sterilisation (21.2 Mt of ROM coal) and reduction in net benefits to NSW of approximately \$220 million in net present value (NPV) terms.

Notwithstanding, 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, in consideration of potential environmental, mining and infrastructure constraints (particularly the number of Upland Swamps within Area 4).
- Siting surface infrastructure to avoid direct impacts to Upland Swamps, other than minor disturbance associated with the installation of monitoring equipment.
- Alternative longwall geometry/methods within Areas 5 and 6 have been considered (e.g. narrower longwall widths), however, potential impacts to Upland Swamps associated with alternative longwall layouts would still be expected (described below) (MSEC, 2019a).
- The implementation of the mine constraints and setbacks for the Project (i.e. from Dam walls, FSLs, named watercourses and key stream features) would result in avoidance of directly undermining a number of Upland Swamps including Den124, Den115, Den131, Den132, Den119 and Den134 (Figure 1).
- The Project relinquishes the existing authority to impact certain Upland Swamp vegetation areas within Area 3, for which offsets have previously been secured.

Residual predicted impacts to Upland Swamps due to the Project are proposed to be offset consistent with the Swamp Offset Policy. It is noted that the Project offset liability includes:

- offsets for potential subsidence impacts to Upland Swamp vegetation; and
- offsets for threatened fauna species for which the Upland Swamps provide habitat (including threatened species such as the Littlejohn's Tree Frog and the Giant Burrowing Frog).

Unnamed Tributaries

It is not feasible to develop a mine plan that would avoid the undermining of all watercourses and stream features.

South32 acknowledges that the ephemeral drainage lines located above the Project longwalls are expected to experience the full range of predicted subsidence movements. However, the unnamed drainage lines are considered to be less significant than the named watercourses (which have been setback from the Project longwalls), on the basis that they:

- are ephemeral (i.e. do not exhibit permanent flow);
- are not mapped Key Fish Habitat;
- have relatively small sub-catchments and therefore small associated contributions to total catchment yields; and
- are of lower stream order (generally first and second order with small sections of third order), are common throughout the catchment area and are not regulated watercourses for water supply transfer.

In determining the Project biodiversity offset liability, the BARBOS (Appendix D of the EIS) assumed that subsidence-related impacts would result in impacts to the habitat of threatened species (Littlejohn's Tree Frog, Giant Burrowing Frog and Red-crowned Toadlet) along 100% of drainage lines directly above and within 60 m of the proposed longwalls, as well as 50% of drainage lines between 60 m and 400 m from the proposed longwalls.

The consequences of subsidence-related impacts to relevant threatened fauna species habitat would be offset, as the Project Biodiversity Offset Strategy accounts for potential losses of habitat due to hydrological changes to ephemeral drainage lines overlying the Project underground mining areas.

Accordingly, the following comment from BCD is not correct:

Ecological importance of un-named tributaries fails to consider presence of threatened frogs, which is a significant omission.

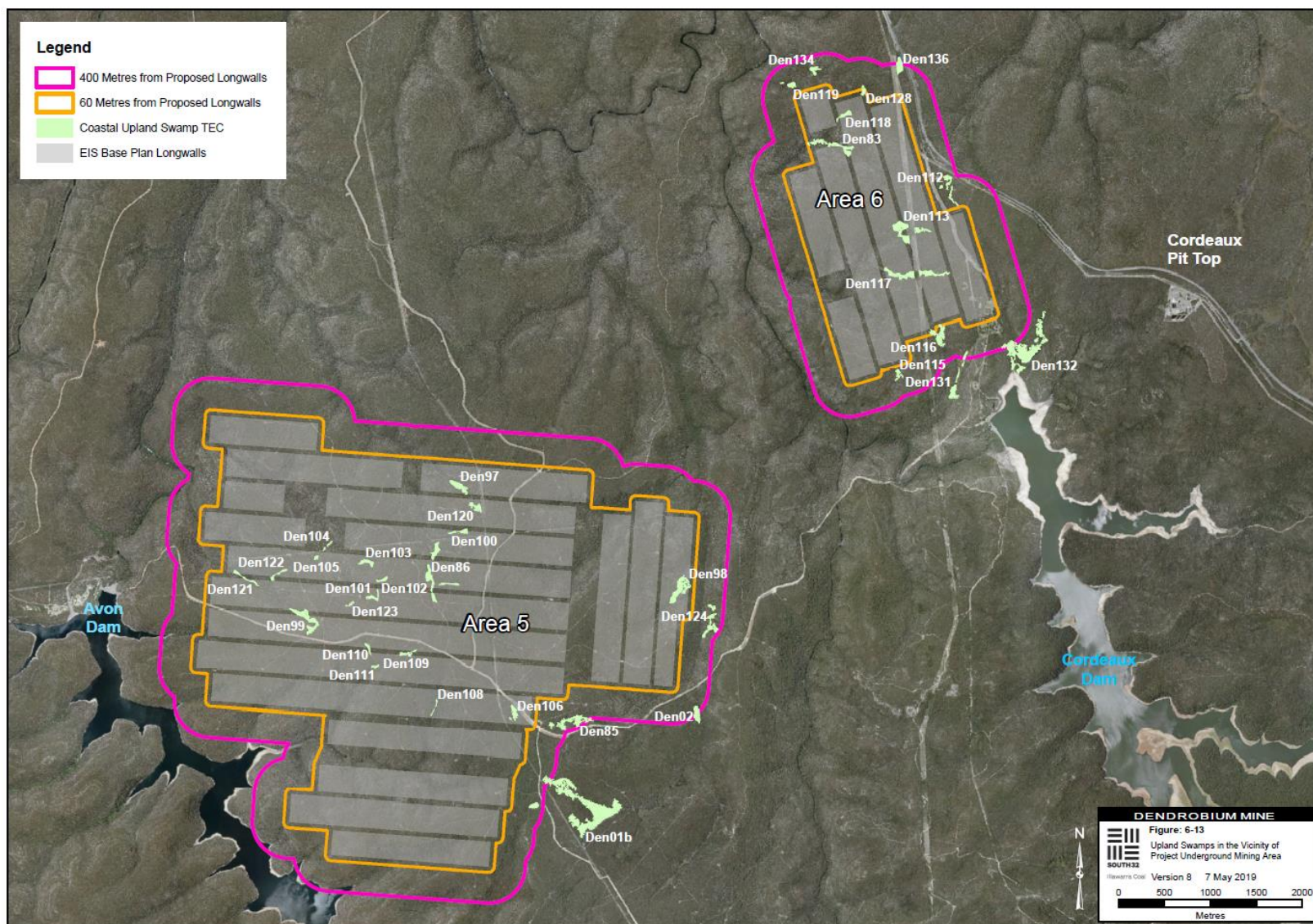


Figure 1: Upland Swamps in the Vicinity of the Project Mining Area

Consideration of Alternate Mine Layouts

South32 has considered alternative mining methods and various mining geometries in the Project mine design, including panel widths of less than the proposed 305 m wide panels (refer to Section 9 of the EIS and 6.5.3 of the Submissions Report for further detail).

While South32 considered various mining geometries in design of the Project, including panel widths of less than the proposed 305 m wide panels, experience at the Dendrobium Mine and other mining operations shows that surface impacts related to subsidence (e.g. at watercourses and Upland Swamps) can occur regardless of panel width, and at panel widths significantly narrower than 305 m (Section 6.5.3 of the Submissions Report).

Accordingly, adverse environmental impacts are still anticipated for reduced longwall widths down to approximately 150 m (MSEC, 2019a).

In regard to Upland Swamps, potential for impacts to Upland Swamps associated with alternative longwall layouts would still be expected (Section 6.9.3 of the Submissions Report).

Therefore, the continuation of 305 m wide panels avoids further Project value loss and coal sterilisation when compared to mining with narrower longwall panels (e.g. due to reduced operational costs and increased coal recovery), and is consistent with previous mining experience at the Dendrobium Mine.

As described above, in consideration of proposed offset measures for predicted impacts to watercourses and Upland Swamps, their associated vegetation and any biodiversity habitat, South32 considers the proposed 305 m wide longwall panels can be mined with acceptable impacts.

Comment 5: Use of the Incremental Profile Model to Assess Subsidence Predictions in Areas 5 and 6.

BCD stated:

Subsidence impacts and consequences are significantly underestimated for the project, especially in Area 5.

The 200mm closure criterion is inappropriate as a risk or set back design criterion for Type 3 pool impacts, and the IEMPC has recommended this criterion be “revised downwards” for watercourses.

IESC support for use of the IPM in subsidence assessment in the Southern Coalfields is noted, and we agree in principle the IPM is appropriate for measuring subsidence impacts.

Notwithstanding, the subsidence predictions for Dendrobium Area 5 use the ‘old’ IPM subsidence model, which does not adequately account for recent experiences at Area 3B and underestimates the subsidence due to 305m longwalls (potentially by approximately 30%).

The argument that the ‘original IPM’ provided ‘reliable predictions’ is not sound for 305m longwalls, since the database used to develop predictions for the ‘original IPM’ included very few if any 305m longwalls.

Longwalls used in the strain analysis for Area 5 (Table 4.5 in Subsidence Assessment) contain no longwalls greater than 200m in width or depths of cover greater than 250m.

The EIS and RTS underestimates likelihood and consequence (i.e. risk) of Type 3 pool impacts occurring.

The Type 3 pool impacts assessment ignores experiences in the Upper Georges River and Eastern Tributary. It therefore underestimates likelihood and consequence (i.e. risk) of Type 3 pool impacts occurring.

South32 Response

Subsidence Modelling Methodology

South32 disagrees with BCD’s statement that the Project subsidence predictions “use the ‘old’ IPM subsidence model, which does not adequately account for recent experiences at Area 3B and underestimates the subsidence”.

The IPM has been used throughout the life of the Dendrobium Mine, and MSEC (2019b) has calibrated the model to incorporate monitoring data from Dendrobium Mine Areas 1, 2, 3A and 3B.

As noted by the BCD, measured vertical subsidence, in some cases, has historically exceeded the subsidence predictions using earlier calibrations of the subsidence model by up to approximately 30% due to the influence of geology in the Dendrobium Mine areas (i.e. due to increased pillar compression from the thicker Wongawilli Seam for Area 3A and Area 3B) (Section 6.5.3 of the Submissions Report).

For the Project, these historical underpredictions were accounted for by increasing the subsidence predictions in Area 6 by 30% (similar to Area 3B, Area 6 is also proposed to mine the Wongawilli Seam).

This correction has not been applied to Area 5 as it is proposed to be mined in the Bulli Seam, which has a thinner seam thickness. Notwithstanding, the component of pillar compression in the model has been increased for Area 5 so that the maximum predicted subsidence values are similar to the maximum achievable subsidence for any single-seam mining in the Bulli Seam. This conclusion is supported by ground monitoring data from NSW coalfields (Section 6.5.3 of the Submissions Report).

Although monitoring at the Dendrobium Mine shows that some observed subsidence movements have historically exceeded the predictions, these occurrences are limited to a local scale and that while measured movements can be greater than predictions, exceedances are also expected to be within the orders of accuracy of the predictive methods (Appendix A of the EIS).

Overall, since model re-calibration to account for historical underpredictions, the IPM model used at the Dendrobium Mine has shown that subsidence movements observed at Dendrobium Mine are typically less than the subsidence predictions, and provides reasonable, if not, conservative predictions of the conventional and non-conventional subsidence effects (Section 6.5.3 of the Submissions Report).

It is noted that BCD raised that previously mined longwalls used in the strain analysis for Area 5 in the Subsidence Assessment (Appendix A of the EIS) did not consider longwalls of panel width similar to the Project longwalls. However, MSEC (2019b) concluded that the strain analysis provided a reasonable indication of the range of potential strains for Area 5.

Setbacks from Named Watercourses

The 'rockbar model' has been used for the Project to estimate potential impacts to streams, and define setbacks from named watercourses such that the maximum predicted additional Project closure is limited to 200 mm.

The rockbar model design tool relates the likelihood of subsidence impact with predicted valley closure along the stream using data from longwall mining in the Southern Coalfield, including an extensive database from Dendrobium Mine.

As noted by BCD, the IEP Part 2 Report recommended that the concept of restricting predicted valley closure to a maximum of 200 mm to avoid significant environmental consequences as a design tool be revised for watercourses (IEP, 2019b).

While South32 acknowledges that in some localised cases in Area 3B impacts have been observed at predicted total closure values of less than 200 mm (as is predicted by the rockbar model, albeit at a likelihood of between 0 to 10%), the application of restricting target total closure to 200 mm as a setback design tool has been successfully used at Dendrobium Mine to date and at other mines in the Southern Coalfield to significantly minimise the likelihood of impacts.

As such, the Project longwalls have been setback from named watercourses such that the maximum predicted additional closure is limited to 200 mm (Section 6.5.3 of the Submissions Report).

As a result, the likelihood of potential impacts resulting in fracturing and observable stream flow diversion (i.e. Type 3 impacts) are predicted to be low (less than 10%) for the small sections of Avon River, Cordeaux River and Donalds Castle Creek within 400 m the Project longwalls (noting that beyond 400 m, these impacts are not likely to occur).

It is noted that flows in the Avon and Cordeaux Rivers are regulated (i.e. flows are determined by dam releases). Historically, controlled flows have been in the order of 10 ML/day. With these flow rates, any Type 3 impacts are unlikely to cause discernible periods of low or now flow, as the rate of any losses to the surface fracture network would be significantly lower than the regulated flows in the Avon and Cordeaux River.

Setbacks from Key Stream Features

Monitoring at the Dendrobium Mine has shown that the impacts (i.e. Type 3 impacts) at key stream features generally occurred after they have been directly undermined, and were not observed prior to longwalls approaching within 50 m of the feature (MSEC, 2019b). As such, South32 has implemented setbacks of 50 m or 100 m (where mining would occur on two or more sides) from the Project longwalls to key stream features to minimise potential subsidence impacts.

South32 would implement remediation measures to mitigate physical damage to key stream features where monitoring indicates that subsidence-related impacts have occurred as a result of the Project.

Comments 11 and 12: Performance measures for Coastal Upland Swamps / threatened species

BCD stated:

These measures are capable of being conditioned into any approval should consent be granted. We reiterate our request for opportunity to input into conditions.

However as detailed above, the credit calculation for a number of threatened species including notably Coastal Upland Swamps remains unsatisfactory.

As noted above, it is considered that subsidence impacts should be revisited through alternate mine layouts or coal extraction methods to limit what are almost certain to be further irreversible impacts. Assessing performance measures should occur within that context.

South32 Response

As described in the response to Comment 1, avoidance of Upland Swamps was considered for the Project as well as consideration of alternative Project longwall layouts. Residual impacts to Upland Swamps would be offset in accordance with the Swamp Offset Policy.

Further detail in regard to the calculation of the Upland Swamp offset liability for the Project is described in the response to Comments 2, 3, 4 and 13.

It is BCD's position that subsidence impacts to swamps should be offset on the basis that all vegetation is assumed to be removed (i.e. 'total impact' scenario). Under this scenario, it is unclear why Upland Swamps would be required to be fully offset and also require assessment against performance measures. The conditioning of performance measures for Upland Swamps that are also required to be offset would be more appropriate for a 'partial impact' offsetting scenario, and if performance measures are exceeded over the life of the Project this would trigger the requirement for additional offsets.

Comment 14 – Review of Hydrological Modelling

BCD stated:

As of May 2018, direct longwall mining impacts at Dendrobium (fracturing, flow diversions and/or pool water loss) had or were highly likely to have occurred in approximately 36 km of watercourses.

None of these impacts have been remediated and it is very unlikely that appropriate remediation will be applied to much of the impacted stream network.

Approximately 37 km (5%) of watercourses located above the proposed longwalls for the Dendrobium Area 5 and Area 6 would be expected to experience direct mining induced impacts.

All of these stream networks lie within the Metropolitan Special Areas, an important part of the Sydney Drinking Water Catchment, and are in addition to other serious mine impacts within other areas of Sydney's Drinking Water Catchment.

Overall, this represents around 14 % of the total length of watercourse within the upper Avon River and Cordeaux River catchments.

It is unlikely that these impacts can or will be appropriately remediated. The impacts will be irreversible. Therefore, the proponent cannot feasibly or reasonably be accepted to commit to remediation of the entire length of streams currently affected (36km) or proposed to be affected (37km) by Dendrobium Mine.

It is highly unlikely that any of the proposed actions (eg. remediation) will lead to either:

- *Restoration of key habitat and ecosystems; or*
- *Restoration of flows and pool holding capacity to WC21 and DCC*

The proposed flow losses will have a very significant impact on availability of aquatic habitat and threatened species. There is no rigorous scientific evidence available that demonstrates diverted water returns to the stream network above longwall mining operations.

The groundwater assessment indicates widespread surface to seam fracturing will occur above Dendrobium Areas 5 & 6. The level of such impacts could easily be mitigated against by a reduction in panel width and increase in pillar width.

Despite assertions to the contrary, there is no rigorous scientific evidence available that demonstrates diverted water returns to the stream network above longwall mining operations.

Remediation measures will not fully address water losses and many of these losses will likely remain in perpetuity.

South32 Response

Consideration of Potential Impacts to Water Resources

South32 recognises the importance of the Metropolitan Special Area to the water supply system and the potential impact the Project may have on the availability of water resources within the catchment.

Overall, maximum predicted surface water losses for the Project represent a negligible impact to the yield of the Metropolitan Special Area (predicted to be less than 1% reduction).

The Project groundwater model adopted a number of conservative assumptions in the prediction of surface water losses, including that surface water lost from watercourses above the Project longwalls is permanently “lost” to the groundwater system.

South32 disagrees with BCD’s statement that “*there is no rigorous scientific evidence available that demonstrates diverted water returns to the stream network above longwall mining operations*”. A significant portion of these losses are likely to re-emerge downstream of the mine footprint, as shown by monitoring data from the Area 3B gauging stations:

- Loss of surface flow has been observable and discernible at stream flow gauges located immediately above or downstream of Area 3B (e.g. WC21, DC13S1 and DCS2). Losses at these sites can be significant, with reductions in median flow being approximately 50-80% of pre-mining median flow.
- However, corresponding changes in surface water flow at gauges further downstream were not discernible (i.e. DCU and WWL). This indicates that some portion of localised losses at WC21, DC13S1 and DCS2 re-emerged downstream and/or the volume of water lost was insignificant compared to the total flow at the downstream gauging stations (see Appendix B of the Project EIS as well as recent analysis in Watershed HydroGeo, 2019).

South32 has committed to offset predicted surface water losses such that there would be a net gain to Metropolitan drinking water supplies.

Stream Remediation

The EIS acknowledges that the ephemeral drainage lines located above the Project longwalls are expected to experience the full range of predicted subsidence movements, and does not propose to remediate physical damage that may occur to these streams.

If physical damage to named streams and key stream features occurs due to the Project as a result of subsidence impacts, remediation techniques would be implemented to repair the physical damage where possible.

Remediation measures would be consistent with the existing mitigation and remediation measures described in the approved *Watercourse Impact, Monitoring, Management and Contingency Plan* (South32, 2019b), which would be reviewed and updated for the Project.

South32 would also use an adaptive management approach to incorporate any learnings and experience from existing Dendrobium Mine operations (e.g. results from rehabilitation trials) and other mining operations in the implementation of Project remediation and management works, for example:

- South32 is currently in consultation with Government agencies regarding the finalisation of trial rehabilitation for the undermined tributary WC21 at Dendrobium Mine;
- South32's rehabilitation plan for the Georges River (at the Bulli Seam Operations) is likely to be finalised in 2020, and would involve injection grouting at a number of sites to remediate subsidence impacts; and
- results of stream remediation undertaken at Tahmoor and Metropolitan Mines.

It is noted that stream remediation has been successfully undertaken at other mines in the Southern Coalfield, as noted by the IEP Part 2 (2019b) report:

6.1.7 Remediation

- *Remediation efforts do not restore the entire watercourse to pre-impact conditions, but may restore water holding capacity to some rockbars and pools in streambeds.*
- *Based on field observations and some submissions, the Panel considers that the PUR remediation technique used in Waratah Rivulet has been successful for restoring pool levels.*

Specifically, in regard to stream remediation undertaken at the Metropolitan Mine, the IEP (2019a) notes:

For Waratah Rivulet this has resulted in remediation of cracks in rockbars by grouting which, in terms of restoring pools, has been successful.

...

The Peabody (Metropolitan Mine) submission states that the PUR injection into the rockbars WRS3 and WRS4 on Waratah Rivulet has restored pool levels to pre-impact levels over time.⁶³ WaterNSW agreed that the remedial grouting has been successful in restoring a substantial proportion of natural flows, but commented that the actual proportion of natural flow cannot be quantified due to inadequate baseline monitoring and a lack of any agreed remedial success methodology.

...

Panel members who had walked Waratah Rivulet before remediation were impressed with the visual improvement in ecological values and water quality on the day of the field visit but, like WaterNSW, recognised that the extent of restoration of natural flow and ecological values could not be quantified due to a lack of baseline data.

Potential residual impacts to relevant threatened species with habitat that may be affected by reductions in stream flow and/or impacts to Upland Swamps due to subsidence-related impacts from the Project would be offset in accordance with Government Policy.

Comments 2, 3, 4 and 13 – Coastal Upland Swamp TECs

Comment 2 – Offsets for Coastal Upland Swamp TEC incorrectly calculated under the FBA guidelines and Upland Swamp Offset Policy

BCD stated:

The proponent is not able to claim any offsetting liability reduction or benefit for not undermining upland swamps or threatened species habitat in any other area, including Area 3. No credits were calculated, created, purchased or retired under earlier approvals and any agreements from previous approvals are not legally tradeable from the DPIE perspective.

We strongly disagree with the proponent's interpretation of the Upland Swamps Offset Policy. Partial loss is only relevant to the spatial extent greater than negligible environmental consequences. This is defined in terms of loss of groundwater only, and has no relevance to vegetation condition at any time following mining. Attempts to reduce credit liability on the basis of short-term vegetation monitoring at other swamps is an incorrect application of the policy.

Credit calculation is required under the 'worst-case scenario' for swamps, which includes significant erosion and scouring, equating to total loss of swamps. Recent examples of this type of impact have occurred in Newnes Plateau Shrub Swamps affected by fires in January 2020.

In Carne West and Gang Gang swamps that have been undermined and desiccated, peat has been turned to ash by fire, with ash beds 30cm or more thick in places and channelization commencing. This is the likely irreversible outcome for undermined Dendrobium swamps and threatened species within them (e.g. giant dragonfly) when they are affected by future fires.

Application for reduction in maximum predicted offset liability is available only in relation to a measured negligible change in shallow groundwater regime at an undermined swamp after it is undermined (pp 10-11 of Upland Swamp Offset Policy). Reduction in credit calculation prior to mining is not permitted under the Swamp Offset Policy.

Comment 3 – Offset for Coastal Upland Swamp TEC

BCD stated:

We note that an additional Maddens Plains offset site has been sourced.

However, as detailed under Key Issue 2 above, we maintain that the FBA and supporting swamp offset policy has been incorrectly applied and needs to calculate the maximum offset liability for swamps. The proponent has therefore not demonstrated to date that like-for-like offsets for all swamps impacted can be sourced, even when including the preliminary credit analysis for the recently acquired property.

DPIE maintains that the Maddens Plains Strategic Biodiversity Site cannot be used to source credits for new projects.

The conditions for the BSO and Dendrobium projects legally prevent this property being used for offset obligations for these earlier projects (and subsequent modifications) only.

The NSW Biodiversity Offsets Policy for Major Projects states that residual impacts must source like-for-like offsets. And, "Supplementary measures", such as research and management actions, can only be used as a "last resort" once all "reasonable steps" have been taken to secure like-for-like offsets (Appendix A, p22 & Appendix B, p26).

Supplementary measures cannot be targeted for Commonwealth EPBC Act- listed matters, such as Coastal Upland Swamps, unless directed to the entity impacted (Appendix B, p28).

NPWS, as the Government land owner, does not support research or management measures (Table 10-6A) in the Dharawal reserves being used to source direct offsets for impacted swamps or threatened species. This assertion should not have been made in the RTS as the matter, while discussed with NPWS, was not advanced and never supported.

The RTS significantly overstates the potential effectiveness of swamp rehabilitation for undermined, drained and desiccated swamps. Rehabilitation of swamps that has occurred elsewhere, such as Happy Valley (see Attachment B) are not relevant as they were not undermined and were still supported by intact hydrological regimes.

None of the swamps impacted by Dendrobium undermining have been remediated and the proponent has not initiated remediation action in any previously undermined upland swamp, despite being a condition of consent for previous approvals. Impacts to swamp EECs are considered irreversible and will remain in perpetuity. Undermined swamps subject to hydrological changes are almost certain to be completely desiccated resulting in peat incineration and total loss of vegetation during a significant fire event. These swamps are not capable of rehabilitation, as confirmed in recent site visits to the bushfire-affected Newnes Plateau (see Attachment B). Species credits for giant burrowing frog and Littlejohn's Tree Frog require the species to be present at the proposed offset site. No evidence of presence is provided. Assumed presence in habitat is not consistent with the NSW Biodiversity Assessment Method (BAM) and credits cannot be created where the species does not exist.

As such, it is considered that subsidence impacts should be revisited through alternate mine layouts or coal extraction methods to limit what are almost certain to be further irreversible impacts of significant magnitude in areas with an in-perpetuity legacy of cumulative adverse outcomes.

South32 Response

Offset Liability Reduction for Relinquishment of Approval to Impact for 0.7 ha of Swamp at Area 3

Satisfying the Project Upland Swamp offset liability via generation of additional Upland Swamp credits using the Maddens Plains Offset Site is not proposed for the Project.

Condition 15, Schedule 2 of the Dendrobium Mine Development Consent (DA 60-03-2001) states:

15. *If the Applicant is required to provide a biodiversity offset pursuant to this consent (including any biodiversity offset that is required under the conditions of a subordinate approval issued in accordance with this consent), the Secretary, in consultation with OEH, may accept in satisfaction of the requirement for the biodiversity offset, the provision of land that has conservation values which exceed the conservation values required to meet the relevant offsetting requirement.*

...

As described in the Project EIS and Submissions Report, a component of the Project is a commitment by South32 to avoid impacts to certain Coastal Upland Swamp TECs approved to be undermined in Dendrobium Mine Areas 3 (i.e. Den02 – 0.7 ha). Therefore, the Strategic Biodiversity Offset at Maddens Plains would contain biodiversity values in excess of the offset requirements of Dendrobium Area 3.

A letter from the then NSW Department of Planning and Environment (now DPIE), dated 16 December 2016, provides that the Secretary approved the Strategic Biodiversity Offset at Maddens Plains in accordance with Condition 15, Schedule 2 of DA 60-03-2001. The letter also states:

If mining in Area 3 of the Dendrobium Coal Mine does not proceed as currently proposed, the Department would consider future proposals to utilise the biodiversity values provided at the Maddens Plains site for further offsetting purposes.

The reduction in Project offset liability due to relinquishment of Upland Swamps approved to be impacted in Area 3 (and already explicitly offset by Maddens Plains) was determined on the basis of area of Coastal Upland Swamp TEC (i.e. not biodiversity credits) and revised Project credit requirements were calculated using the total area reduced by Area 3 Upland Swamps no longer proposed to be impacted (i.e. 20.9 ha as per Table 1).

Table 1: Coastal Upland Swamp TEC Revised Biodiversity Offset Liability

Offset Liability	Coastal Upland Swamps within 60 m of Project Longwalls	To be Relinquished - Coastal Upland Swamp TEC Previously Approved to be Impacted in Area 3	Net Increase in Areas of Coastal Upland Swamp TEC to be Impacted by the Project
Coastal Upland Swamp TEC	21.6 ha	Den02 - 0.7 ha	20.9 ha

Source: Niche (2019)

There are numerous examples where the BCD has accepted relinquishment of an already approved and offset impact (e.g. undermining of Den02 which is explicitly offset by the Maddens Plains Offset Area) to reduce the offset liability for additional impacts to an equivalent vegetation community for an addition project.

Application of Swamp Offset Policy

The Swamp Offset Policy relevantly states (underlined for emphasis):

Where it is predicted that a partial impact to an Upland Swamp is likely, then only the portion of the swamp likely to experience greater than negligible environmental consequences should be included in the offset calculation.

Greater than 'negligible environmental consequences' are defined as including one or more of the following:

- a shallow groundwater level within swamp sediments lower than the baseline level at any monitoring site within a swamp (in comparison to control swamps); and/or
- a rate of shallow groundwater level reduction post-mining that exceeds the rate of shallow groundwater level reduction during the baseline period at any monitoring site (measured as average millimetres per day during the recession curve).

'Negligible environmental consequences' are defined in the Swamp Offset Policy to mean one or more of the following:

- negligible change to the shallow groundwater regime of a swamp compared with control swamps; and/or
- negligible change to the composition or distribution of swamp dependent vegetation communities and threatened species.

The Swamp Offset Policy also provides:

It is recognised that the impact of altering the hydrological regime within Coastal Upland Swamps is not equivalent to removing all vegetation ...

The Swamp Offset Policy is an addendum to the *Biodiversity Offset Policy for Major Projects* (OEH, 2014) (NSW Offset Policy) and supporting *Framework for Biodiversity Assessment* (FBA). The FBA requires the use of the *Credit Calculator for Major Projects and BioBanking* (version 4.0) (BBCC). The FBA *Credit Calculator for Major Projects and BioBanking: Operational Manual* (OEH, 2016) (the BBCC Manual) provides the ability to amend site value scores to reflect an impact other than complete clearing (refer Section 14.9 of the BBCC Manual):

... You can adjust the scores in the Score with development (0–3) column for each of the 10 attributes, based on the condition of the vegetation after development. If the site is to be completely cleared, retain all scores at zero. However, if the management zone is only going to be thinned or partially impacted (such as for an APZ), the score for each site attribute should be amended to a more appropriate level.

For the purposes of calculating the Project Upland Swamp maximum offset liability the transition to a drier vegetation type following undermining was assumed, however, review of monitoring data by Niche (2019) did not conclude there is a strong link between subsidence effects to hydrological regime and Upland Swamp vegetation response (Section 6.9.3). Therefore, the calculation of the Project Upland Swamp maximum offset liability has amended the vegetation site value scores to reflect a transition vegetation type (i.e. partial impact scenario), rather than total impact.

Table 55 of the Project BARBOS (reproduced as Table 2 below) provides the site value scores applied to Upland Swamps within 60 m of the proposed longwalls. The 'score with development' considers that these Upland Swamps would not be completely cleared by the Project and vegetation would persist.

The drier vegetation type is likely to be similar to Red Bloodwood – scribbly gum heath woodland (HN566) or Upland Swamp Fringing Woodland (which has the same PCT as the Upland Swamp TEC, HN560). Red Bloodwood – scribbly gum heath woodland (HN566) support similar threatened species to Upland Swamp TEC habitat (Table 3).

Additional Stewardship Site

Since lodgement of the Project EIS, South32 secured an additional landholding (the Offset Property) which may be established as a Stewardship site to address biodiversity requirements, in particular those associated with Upland Swamp TECs. Refer to Section 6.10.3 of the Project Submissions Report for further detail of the location and results of preliminary habitat assessment of the Offset Property.

Offset credits generated by the Property may be used to satisfy a portion of the Project's offset liability. The remaining portion would be satisfied using available mechanisms under the BC Act and NSW Offset Policy including:

- Payment into the Biodiversity Conservation Trust (BCT) Payment Fund; and/or
- Other direct or supplementary measures.

Swamp Remediation

It is not proposed to offset the impacts of the Project to Upland Swamps using rehabilitation of previously undermined swamps.

South32 is conducting research into methods for swamp rehabilitation as described in the Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan (South32, 2019c) and Dendrobium Area 3B Swamp Rehabilitation Research Program (South32, 2016).

Subject to confirmation from key stakeholders that swamps undermined in Area 3 have been successfully remediated, swamp remediation measures could be implemented for the Project and South32 would seek to reduce the Project's Upland Swamp offset liability accordingly.

Table 2: Proposed BBCC 'site value' scores

Benchmark	Current score (0-3)	Score with development assuming the persistence of native vegetation and habitat (0-3)	Justification for change in score
HN560 Needlebush - banksia wet heath on sandstone plateau of the Sydney Basin Bioregion			
Native plant species:	3	2	Native richness may decline due to shading of overstorey and mid-storey due to transition to Eucalypt Fringing Woodland. The impacts of shading from transition Coastal Upland Swamp sub-vegetation types is discussed in Keith (2007) As such, the score has been reduced by one score rather than a scenario assuming the complete loss of native plant species.
Native over-storey cover:	1	1	Score already at 1. It therefore cannot be increased, however it is worth noting that the overstorey is likely to increase due to regeneration of canopy species as a Coastal Upland Swamp becomes drier.
Native mid-storey cover:	3	3	The shrub layer score is at the maximum permissible as mid-storey is likely to increase due to transitions to a drier vegetation community. Drier vegetation types include Banksia thicket which has a greater percentage of mid-storey cover compared to wetter vegetation communities.
Native ground cover (grasses):	1	1	Grasses should increase as swamp becomes drier and transitions to Eucalypt Fringing Woodland.
Native ground cover (shrubs):	3	3	Shrubs will increase as swamps become drier. Drier vegetation types include Restioid Heath and Banksia thicket which has a greater percentage of shrub cover compared to wetter vegetation communities.
Native ground cover (other):	2	1	Native ground-cover (other) may decrease due to transitioning vegetation types, however will not be completely lost. As such, the score has been reduced by one.
Exotic plant cover:	3	3	This will not change given area does not contain weeds.
Number of trees with hollows:	0	0	No change in score permissible.
Overstorey regeneration:	3	3	There will be regeneration in overstorey. No change expected
Total length of fallen logs:	0	0	No change in score permissible.
Current Site Value Score (out of 100)		67.39	
Future Site Value Score		55.80	
Decrease in Site Value Score		11.59	
HN662 Needlebush - Banksia wet heath swamps on coastal sandstone plateaus of the Sydney basin			
Native plant species:	3	2	Native richness may decline due to shading of overstorey and mid-storey due to transition to Eucalypt Fringing Woodland. The impacts of shading from transition Coastal Upland Swamp sub-vegetation types is discussed in Keith (2007) As such, the score has been reduced by one score rather than a scenario assuming the complete loss of native plant species.
Native over-storey cover:	3	3	Score already at 3. It therefore cannot be increased, however it is worth noting that the overstorey is likely to increase due to regeneration of canopy species as a Coastal Upland Swamp becomes drier.

Benchmark	Current score (0-3)	Score with development assuming the persistence of native vegetation and habitat (0-3)	Justification for change in score
Native mid-storey cover:	0	0	The shrub layer score has been increased to the maximum permissible as mid-storey is likely to increase due to transitions to a drier vegetation community. Drier vegetation types include Banksia thicket which has a greater percentage of mid-storey cover compared to wetter vegetation communities.
Native ground cover (grasses):	3	3	Grasses should increase as swamp becomes drier and transitions to Eucalyptus Fringing Woodland.
Native ground cover (shrubs):	3	3	Shrubs will increase as swamps become drier. Drier vegetation types include Restioid Heath and Banksia thicket which has a greater percentage of shrub cover compared to wetter vegetation communities.
Native ground cover (other):	2	1	Native ground-cover (other) may decrease due to transitioning vegetation types, however will not be completely lost. As such, the score has been reduced by one.
Exotic plant cover:	3	3	This will not change given area does not contain weeds.
Number of trees with hollows:	0	0	No change in score permissible.
Overstorey regeneration:	3	3	There will be regeneration in overstorey. No change expected
Total length of fallen logs:	0	0	No change in score permissible.
Current Site Value Score (out of 100)		99.07	
Future Site Value Score		83.33	
Decrease in Site Value Score		15.74	

Source: Niche (2019)

Table 3: Predicted threatened species in Coastal Upland Swamp units (HN560 & HN562) compared to HN566

Common name	Species	TS offset multiplier	Predicted to occur in Coastal Upland Swamp (HN560 & HN562)	Predicted in Exposed Sandstone Scribbly Gum Woodland (HN566)
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	2.2	Y	Y
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	2.0	Y	Y
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	2.2	Y	Y
Little Eagle	<i>Hieraaetus morphnoides</i>	1.4	Y	Y
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8	Y	Y
New Holland Mouse	<i>Pseudomys novaehollandiae</i>	3.0	Y	Y
Scarlet Robin	<i>Petroica boodang</i>	1.3	Y	Y
Spotted Harrier	<i>Circus assimilis</i>	1.4	Y	N
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	3.0	Y	Y
Swift Parrot	<i>Lathamus discolor</i>	1.3	Y	Y
Eastern false pipetrelle	<i>Falsistrellus tasmaniensis</i>	2.2	N	Y
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	1.8	N	Y
Varied Sittella	<i>Daphoenositta chrysoptera</i>	1.3	N	Y

Source: Niche (2019)

There are a number of Upland Swamps on the Illawarra Escarpment that have been disturbed by previous land uses, including access tracks and electricity transmission lines.

If South32 implemented or funded additional remediation and rehabilitation measures in Upland Swamps within the Dharawal Reserves or other areas (in coordination with NPWS or the relevant landowner), it would provide a material increase to biodiversity values that could contribute to the Project's biodiversity offset strategy. Regardless, it is understood the Upland Swamp offset liability could be addressed by paying into the BCT.

As noted by the BCD, rehabilitation of swamps impacted by previous land uses have been successful. The Submissions Report provides further examples of successful rehabilitation of previously disturbed swamps.

Bushfire-related Impacts to Upland Swamps

It is not the responsibility of South32 to offset areas affected by bushfires.

Bushfire-related impacts to vegetation including Upland Swamps are not relevant to the calculation of the offset liability and associated biodiversity offset requirement.

The FBA requires demonstration of minimisation of potential indirect impacts from a development, including increased risk of fire.

The existing Dendrobium Mine Bushfire Management Plan (South32, 2018) would be revised for the Project areas, which includes measures to manage fire risk (i.e. fire breaks, access to fire trails, liaison with RFS).

Bushfire risk management measures currently employed at the Dendrobium Mine as part of the existing Bushfire Management Plan would continue for the Project. Specific mitigation and management measures to reduce bushfire risk include:

- Fire awareness and fire safety training would continue to be included in the induction of appropriate South32 staff and contractors.
- Mitigation measures that would be implemented by South32 to reduce bushfire risk would focus on education and training, reducing bushfire hazard (principally fuel levels), minimising and controlling ignition sources (e.g. by appropriate engineering design, where relevant) and developing appropriate responses and evacuation strategies.

- Suitable firebreaks and/or radiation zones would be established to reduce bushfire hazards, where required. Firebreaks have been established around the existing surface facility locations, including Cordeaux Pit Top, Dendrobium Pit Top and the Kemira Valley Coal Loading Facility, and extensive firefighting water pipelines and booster pump facilities are available around the Dendrobium Pit Top sites. South32 would continue to regularly inspect bushfire management controls on its properties. Bushfire risk management works would be undertaken on an as required basis and would include clearing of excessive growth within property fire protection boundaries.

South32 would continue to consult with WaterNSW and RMS with respect to management of bushfire risk activities within and adjacent to the Project area.

Comment 4 – Peer Review of Upland Swamp Shallow Groundwater Monitoring Data

BCD stated:

This data was supplied shortly after close of the EIS exhibition period.

South 32 Response

Noted.

Comment 13 – Establishment of an Independent Expert Panel for the Southern Coalfields

BCD stated:

DPIE establish a standing independent expert panel as per the Upland Swamp Offset Policy. Its role would be to provide advice to the consent authority on environmental consequences of mining under Coastal Upland Swamps, and to ensure that monitoring of impacts is rigorous and scientifically robust. Consideration be given to requiring the proponent (and potentially other miners in the Southern Coalfields) to fund the panel.

Comment remains valid but can be addressed post-approval.

South32 Response

This comment is addressed to DPIE.

Comments 6, 7, 8, 9 and 10 – Assessment of Surface Disturbance

Comment 6 – Assessment of Ancillary Aspects of Development

BCD stated:

The response in the RTS does not demonstrate that the FBA has been appropriately applied in relation to the Pit Top Carpark extension and further information is still required.

The FBA must be applied to all aspects of the proposed development as presented. The development includes an allowance for clearing 9.5 ha of vegetation in ancillary areas that have not been determined. Key aspects of the FBA, including avoidance, mitigation and offsetting cannot be addressed in the absence of necessary details.

Comment 7 – Avoidance of Native Vegetation Clearing Impacts

BCD stated:

To date no map of hollow bearing trees has been supplied. A map of hollow bearing trees is required to ensure the key FBA component of avoiding biodiversity values is met, in addition to determining whether certain species credit species occur (eg powerful owl).

Comment 8 – Extent of Offset Requirements for the Koala

BCD stated:

SEPP 44 has been revised to reflect improved understanding of regional koala habitat use trees in the new Koala Protection SEPP. Scribbly Gum (E. sclerophylla) is recognised as a key koala habitat use tree in this region (OEH 2018 – A review of koala tree use across NSW – link here) and PCTs with this as a dominant species, including PCT 1083, must be included in calculations for koala habitat. Koala was recorded during surveys for the EIS and is known to be present.

The proponent has not confirmed that the Koala is not present or unlikely to be present at the development site, as required by s6.5.1.11 of the FBA. We therefore maintain that all Koala habitat must be offset.

Comment 9 – Updates to Species Credit Species

BCD stated:

Inadequate assessments have been undertaken given the magnitude of potential loss of threatened aquatic and swamp species.

No electrofishing was conducted in areas of the streams above the proposed longwalls for Dendrobium Area 5 & 6.

We do not agree with the proponent's rationale to treat all surface development areas as a single stratification unit, thus eliminating the need to carry out targeted surveys at individual development sites.

Stratification should not be based purely on PCT type. Other factors including landscape position, disturbance and fire history, distance to water etc. must be considered when determining survey effort.

There is considerable distance between each ventilation shaft (up to 5km), and all sites are easily accessible and of a size able to be surveyed.

The FBA requires a proponent to determine if a candidate species is present on a development site or is likely to use the potential habitat on that site.

If adequate surveys are not carried out to determine whether a candidate species is present or likely to use potential habitat on that site, the species should either: 1) be assumed present, or 2) an expert report prepared to confirm that it does not occur.

The BAR needs to provide clarity that all candidate species credit species were adequately surveyed at each ventilation shaft (and other surface areas to be cleared).

Specific advice for relevant species is provided below:

- Powerful owl: The proponent has not provided detail on hollow bearing trees so it is difficult to conclude the site does not contain breeding or roosting habitat for this species. We do not accept the conclusion that landscape positioning was not appropriate for breeding and roosting habitat for this species. Niche (2019a) states powerful owls roost and nest "in sheltered gullies....within 100m of streams or minor drainage lines...". All ventilation shafts contain either sheltered gullies or watercourses.*
- Rosenberg's goanna: This species is listed as a species credit species under the FBA. A species polygon is required. The proponent should determine if biobanking credits are available for this species and describe evidence of efforts to source these credits. If credits are unavailable this species may be offset via ecosystem credits.*
- Eastern pygmy possum: The RTS relies on the rationale that adequate survey was done based on combined survey effort across the project area. We do not consider this is adequate to confirm the species does not occur at sites where targeted survey was not done.*
- Survey effort, as shown in Figure 10 and detailed in Section 6.3 of the EA, still requires clarification. Further targeted surveys may be required for surface areas that were not adequately surveyed.*

Comment 10 – Updates to Biodiversity Assessment

BCD stated:

To date, no credit calculator updates or shapefiles have been provided.

South32 Response

Ancillary Surface Infrastructure Location

The Project EIS included an allowance for clearance of 9.5 ha of native vegetation in the Project offset liability to account for surface infrastructure (service boreholes and electricity transmission lines [ETLs]) where, at that stage, the location could not be defined. Since lodgement of the Project EIS, South32 has undertaken further design development of this surface infrastructure, including:

- amendment of the disturbance extent of Ventilation Shaft Site No 5A to incorporate:
 - additional service boreholes which previously did not have a fixed location; and
 - ventilation and gas management infrastructure previously located at Ventilation Shaft Site No 5B; and
- finalisation of the alignment of ETLs that will supply the ventilation shafts.

The final ETL alignment was selected to avoid clearing where practical via use of existing fire trails and road reserves. There is no change with regard to South32's commitment to avoid direct impacts to Upland Swamp vegetation from Project surface disturbance works.

Table 4 below provides a breakdown of surface disturbance as proposed in the EIS compared to the updated layout. As shown, the total area of disturbance remains unchanged. The Pit Top Carpark Extension area and Ventilation Shaft Site Nos 6A and 6B also remain unchanged from that proposed and surveyed in the EIS.

Additional Survey Effort

Additional survey for the Project was undertaken between 28 April 2020 and 22 May 2020 (across 11 days and nights) and on 1 July 2020 and focused on the ventilation shaft sites and confirmed ETL alignment. Surveys included vegetation validation and threatened flora and fauna and were undertaken in accordance with the NSW Offset Policy and OEH survey guidelines and databases.

Further detail of survey methodology and coverage, as well as results, is provided in the Supplementary Biodiversity Assessment Report (Niche, 2020) provided in Attachment 1.

In consideration of BCD's comments, the following threatened fauna species were targeted during the surveys:

- Eastern Pygmy Possum (*Cercartetus nanus*).
- Powerful Owl (*Ninox strenua*).
- Koala (*Phascolarctos cinereus*).

Survey methods were selected to detect the target species listed above, however they are also relevant to other potentially occurring threatened fauna within the Project disturbance area.

Updated Project Offset Liability

Updated ecosystem and species credit requirements for the Project have been determined in Attachment 1 and summarised in Tables 5 and 6 below, incorporating refined disturbance extents for surface infrastructure as well as results of additional biodiversity surveys.

Two additional species credit species have been incorporated in the Project offset liability, namely the Eastern Pygmy-possum and Rosenberg's Goanna. There is no change proposed for the offset liability associated with Upland Swamps, vegetation within the Pit Top Carpark Extension area or species credit species that were assessed in the EIS (i.e. Giant Burrowing Frog, Littlejohn's Tree Frog, Giant Dragonfly, Red-crowned Toadlet, Broad-headed Snake or Koala).

Updated credit reports and shapefiles of species polygons and vegetation mapping within disturbance extents will be provided to BCD.

Table 4: Breakdown of Revised Native Vegetation Impacts (Source: Niche, 2020)

PCT Code	BVT Code	BVT Name	Updated Area of Impacted Native Vegetation (ha)								Change
			Ventilation Shaft Site No. 5A	Ventilation Shaft Site No. 5B	Ventilation Shaft Site No. 6A	Ventilation Shaft Site No. 6B	Pit Top Carpark Extension	Service Boreholes	ETL Alignment	Total	
1083	HN566	Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion	15.0	0.5	4.3	4.0	-	-	3.1	26.9	+1.1 ha
1395	HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*	-	-	-	-	-	-	0.55	0.55	-0.95 ha
1250	HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	-	-	-	-	-	-	0.85	0.85	-0.15 ha
1245	HN597	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	-	-	-	-	0.2	-	-	0.2	-
Total			15.0 ha	0.5 ha	4.3 ha	4.0 ha	0.2 ha	0.0 ha	4.5 ha	28.5 ha	-
Change (from EIS BARBOS)			+7.5 ha	-2.5 ha	-	-	-	-5.0 ha	-	-	

Note: Red text indicates the area of impact has increased, green text indicates the area of impact has reduced.

* Shale Sandstone Transition Forest TEC

Table 5: Updated Project Ecosystem Credit Requirements (Source: Niche, 2020)

Impact Mechanism		Vegetation Community		Project EIS		Updated in Response to BCD		Change in Credit Requirement
				Area Impacted (ha)	Credits Required	Area Impacted (ha)	Credits Required	
Surface Disturbance	Ventilation shaft sites and ETL alignment	HN566	1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (PCT 1083)	25.8	1,022	26.9	1,051	+29
		HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395)	1.5	120	0.55	40	-80
		HN651	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250)	1.0	80	0.85	68	-12
	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	0.2	6	0
Subsidence	Upland swamps	HN560	Needlebush - Banksia wet heath on sandstone plateau of the Sydney Basin Bioregion (PCT 978)	16.3	227	16.3	227	0
		HN556	Needlebush - Banksia wet heath swamps on coastal sandstone plateaux of the Sydney Basin (PCT 1804)	4.6	78	4.6	78	0

Table 6: Updated Project Species Credit Requirements (Source: Niche, 2020)

Impact Mechanism		Threatened Fauna Species	Project EIS		Updated in Response to BCD		Change in Credit Requirement
			Area Impacted (ha)	Credits Required	Area Impacted (ha)	Credits Required	
Subsidence	Streams and Upland Swamps	Giant Burrowing Frog (<i>Heleioporus australiacus</i>)	32.74	426	32.74	426	0
		Littlejohn's Tree Frog (<i>Litoria littlejohni</i>)	32.74	426	32.74	851	0
	Cliff lines	Broad-headed Snake (<i>Hoplocephalus bungaroides</i>)	0.28	9	0.28	9	0
	Upland Swamps (breeding/foraging habitat)	Giant Dragonfly (<i>Petalura gigantea</i>)	13.93	1073	13.93	1073	0
	Streams	Red-crowned Toadlet (<i>Pseudophryne australis</i>)	7.21	94	7.21	94	0
Surface Disturbance	Pit Top Carpark Extension and ETL alignment	Koala (<i>Phascolarctos cinereus</i>)	1.5	39	1.51	39	0
	Pit Top Carpark Extension, Ventilation shaft sites and ETL alignment	Eastern Pygmy-possum (<i>Cercartetus nanus</i>)	n/a	n/a	27.25	545	+545
	Ventilation shaft sites and ETL alignment	Rosenberg's Goanna (<i>Varanus rosenbergi</i>)	n/a	n/a	27.05	893	+893

Note: Red text indicates the area of impact has increased, green text indicates the area of impact has reduced.

Comments 15, 16, 17 and 18 – Aboriginal Cultural Heritage

Comment 15 – Consider Alternative to Avoid or Limit Harm to Aboriginal Cultural Heritage

BCD stated:

The proposed mine layout and extraction method remains unchanged from the EIS. The feasibility aspect is not detailed nor demonstrated beyond a claim. Hence, there is no capacity to understand alternatives and what balances there are to any decision making beyond such a claim.

Comment 16 – Subsidence Impacts on Sites of Aboriginal Cultural Heritage Significance

BCD stated:

No measures to reduce subsidence are proposed. No alternatives have been detailed.

Subsidence predictions for all of the sites predicted to be harmed in the ACHAR, as requested in our detailed comments, have not been provided in the RTS.

South32 Response

Impact Avoidance and Minimisation

The proposed surface infrastructure for the Project has been designed to avoid identified sandstone shelters, axe grinding grooves and other natural landscape features (Table 6-15 of Section 6 of the EIS). The location and design of ancillary infrastructure (e.g. access tracks, Project power and/or water supply infrastructure) required progressively over the life of the Project is flexible and would be located to avoid Aboriginal cultural heritage sites as far as practicable.

It is not considered reasonable to avoid undermining all Aboriginal cultural heritage sites within Area 5 and Area 6. Only one identified site of high scientific significance would be directly undermined for the Project.

As described in the response to Comment 1 above, South32 has considered alternative mining methods and various mining geometries in the Project mine design, including narrower panel widths. While narrower longwall panels would reduce total vertical subsidence, adverse environmental impacts (i.e. surface cracking) are still anticipated (MSEC, 2019a) and would result in a significant reduction in resource recovery (and associated economic benefit to NSW).

Predicted Subsidence Impacts

The ACHA described that all of the 58 recorded Aboriginal cultural heritage sites have some potential to be impacted by predicted subsidence movements due to their location on the surface relative to the proposed underground mining area. Note that a structural change due to subsidence does not necessarily contribute to an adverse consequence to the heritage values of the site.

Sixty-one of the 206 sites monitored within the Southern Coalfield are within the existing Dendrobium Mine areas and were predicted to experience subsidence-induced ground movements of the same or greater magnitude than currently predicted for sites within Area 5 and Area 6.

To date, only three of the 61 undermined sites within the existing Dendrobium Mine areas, have been impacted as a result of subsidence movements.

Monitoring of potential impacts to Aboriginal cultural heritage sites would be conducted prior to and following subsidence from longwall mining. The details of the subsidence monitoring program would be outlined in an Aboriginal Heritage Management Plan (AHMP) (refer response to Comment 17 below) and detailed in Extraction Plans for the Project, including site specific TARPs.

Comment 17 – Preparation of Aboriginal Heritage Management Plan

BCD stated:

Response Noted.

South32 Response

BCD's acknowledgment of the response to their original comments regarding the AHMP is noted.

Comment 18 – Extent of Aboriginal Cultural Heritage Consultation

BCD stated:

Comments on consultation not adequately addressed.

The following technical requests have also not been addressed:

- *update the ACHAR to correct identified errors*
- *provide a single map overlay of recorded sites with the proposed longwall layout, and*
- *submit updated AHIMS site cards*

South32 Response

Response to BCD's Technical Requests

Responses to BCD's technical request comments on the ACHA are provided in Table 7. A revised ACHA is not considered to be required and the outcomes of the assessment process undertaken since the ACHA was finalised would be reflected in the AHMP prepared for the Project.

Clarification of Consultation

Cubbitch Barta Native Title Claimants

BCD stated:

It does not appear that Niche (2019, p.17) provided an appropriate response to Cubbitch Barta Native Title Claimants who requested detail of the survey coverage, ground surface visibility and potential for subsurface archaeological deposits in the proposed surface infrastructure areas. The response that this matter can be deferred to an AHMP is not appropriate. This question must be addressed in the ACHAR and an appropriate response provided to the RAPs and BCD.

The Cubbitch Barta Native Title Claimants provided the following comment on the first draft ACHA (provided 5 January 2018):

The areas that will be impacted for ventilation shafts and other infrastructure should be looked at more closely. These areas are from that I can make out on the maps, are on level ridgelines that may have been used for open camp sites. We should not just be considering the impacts of mining on shelters and grinding grooves, but also the impacts on possible subsurface materials, located in these infrastructure areas. I realise that these areas were inspected during the survey, but there was probably little visibility at the time, I cannot find anything specific about these areas in the report.

Note the Cubbitch Barta Native Title Claimants did not provide any further comment on the ACHA during the second draft ACHA review period (provided 2 October 2018).

The response provided in the ACHA is as follows:

Your comments have been noted and can be further explored during the Aboriginal Cultural Heritage Management Plan, should the Project be approved.

Further to the above, the predictive model (Section 7.5 of the ACHA) determined that the majority of stone artefact scatters and isolated artefacts would occur within 200 m of watercourses or drainage lines. The ventilation shaft sites have been sited to avoid direct impacts to watercourses.

Table 7: Responses to BCD Comments on ACHA

BCD Comment	Response
<p><i>The Niche (2019, p.53) statement of significance for site 52-2-1278 is that the site has low scientific significance 'due to the large number of axe grinding grooves at the site and the close proximity to the site Metro Catchment-Art01'. This statement is inconsistent. It is likely that a higher scientific significance assessment is warranted at this site. Niche should clarify the significance statement for site 52-2-1278.</i></p>	<ul style="list-style-type: none"> South32 has reviewed the scientific significance of AHIMS ID #52-2-1278 in consultation with the archaeologist, and agrees that this site is of moderate scientific significance. This will be reflected in the AHMP prepared for the Project.
<p><i>The impact assessment at Table 22 (Niche 2019, p.73) shows that site 52-2-4468 (a grinding grooves site) is expected to be totally harmed resulting in a total loss of value. However, this site is near Ventilation Shaft 5B and surface infrastructure work will avoid harming the site (Niche 2019, p.78). Protective measures to avoid harm during construction of the vent shaft are proposed, including fencing and signage, and we support these measures.</i></p>	<ul style="list-style-type: none"> South32 agrees with BCD's conclusion that there would only be a partial impact to AHIMS ID 52-2-4468 due to subsidence movements, as direct disturbance would be avoided. This will be reflected in the AHMP prepared for the Project.
<p><i>The Niche (2019, p.41) report and MSEC report (2018, p.93) must be updated to be consistent in the number of Aboriginal heritage sites subject to impacts.</i></p>	<ul style="list-style-type: none"> The MSEC report (2019b) did not include a subsidence assessment for AHIMS ID 52-2-1578 as it is located outside of the 600 m study area boundary.
<p><i>The AHIMS site numbers must be included in the ACHAR (for example site Dendrobium ACHA Shelter 2).</i></p>	<ul style="list-style-type: none"> Since submission of the Project EIS, AHIMS site cards have been lodged for each of the newly identified Aboriginal cultural heritage sites. The AHIMS numbers for each of these sites (which would be included in the AHMP) are as follows: <ul style="list-style-type: none"> Dendrobium ACHA AGG-4 (AHIMS ID 52-2-4465). Dendrobium ACHA AGG-3 (AHIMS ID 52- 2-4466). Dendrobium ACHA AGG-2 (AHIMS ID 52-2-4467). Dendrobium ACHA AGG-1 (AHIMS ID 52-2-4468). Dendrobium ACHA Shelter-1 (AHIMS ID 52-2-4469). Dendrobium Shelter-2 (AHIMS ID 52-2-4470).
<p><i>The ACHAR is internally inconsistent in the number of sites being described as inside the study area. There are 60 sites listed in Table 7 (Niche 2019, p.27) and 58 sites described elsewhere (e.g. Niche 2019, p.34). The site count total in Table 18 is also incorrect (Niche 2019, p.63).</i></p>	<ul style="list-style-type: none"> Table 7 provides a summary of the results of the AHIMS search within the Project Area (i.e. includes sites which could not be relocated and also does not include sites which were identified during survey). The total is included in the first row of Table 18 labelled "Area 5 and Area 6". As described in Section 6.10.2 of the Project EIS, there are 58 sites within the Project underground mining area.

BCD Comment	Response
<p><i>The site description for sites 52-2-1734 and 52-2-1735 is identical in Table 12 of the ACHAR (Niche 2019, p.42). This should be corrected.</i></p>	<ul style="list-style-type: none"> As per Section 1.27 of Appendix 5 of the ACHA, the description for AHIMS ID 52-2-1735 is as follows: <i>This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the ceiling of the shelter, and is in poor condition. A wombat burrow is located in the rear of the shelter.</i>
<p><i>Site 52-2-1567 is missing from Table 12 (Niche 2019, p.41).</i></p>	<ul style="list-style-type: none"> The relevant information is provided in Appendix 5 of the ACHA and would be incorporated in the AHMP prepared for the Project.
<p><i>The MSEC report predicted impacts (2018, p.953) should be revised to include all 58 of the sites identified by Niche. Currently the MSEC report only provides predictions for 55 sites. We request a copy of the amended MSEC predictions as this may require amendments to our recommendations.</i></p>	<ul style="list-style-type: none"> The MSEC (2019b) subsidence predictions for Aboriginal cultural heritage sites were only provided for 55 of the 58 recorded sites, as AHIMS IDs 52-2-1734, 52-2-1736 and 52-2-1784 could not be relocated during surveys undertaken for the ACHA. All three sites are recorded on AHIMS as being located outside of the 35 degree angle of draw. Aboriginal cultural heritage sites located adjacent to these recorded locations, which were assessed in the Subsidence Assessment, are not expected to experience measurable conventional tilts, curvatures, strains or valley related upsidence or compressive strains due to valley closure (MSEC, 2019b).
<p><i>A single map overlay combining all recorded sites in the study area (e.g. Niche Figures 12 and 13) with the long wall layout (e.g. MSEC drawing 856-20) should be provided. This is to show the complete set of known sites in relation to the proposed long wall layout. This figure should be included in an amended ACHAR with the impact assessment revised as required.</i></p>	<ul style="list-style-type: none"> The figures showing the location of Aboriginal cultural heritage sites were removed from the ACHA on request of the RAPs, however BCD has separately been provided with relevant figures, and they will be provided again as a component of this response.
<p><i>AHIMS site update cards are required. We recommend that it is a condition of project approval that site update cards are provided to the Aboriginal Heritage Information Management System (AHIMS) where there is new information available (including locational information) or where changes to the site condition are documented.</i></p>	<ul style="list-style-type: none"> AHIMS site card descriptions will be updated where required.

The AHMP (which would be prepared in consultation with the RAPs) would detail management measures for previously unidentified sites including, but not limited to, preclearance and clearance activities, notification requirements and procedures for determining requirement for salvage or excavation in consultation with RAPs and an archaeologist.

South Coast Native Title Claimants

BCD stated:

Niche (2019, pp.7, 15) should clarify the level of consultation with the South Coast Native Title Claimants. We note that the consultation process about Areas 5 and 6 started before the South Coast Native Title Claim was registered. However, Niche (2019, p.15) then undertook a second Native Title search. The actions implemented as a result of this second search need to be explained.

The South Coast People Claimants submitted a Native Title Claim over the Project area on 31 January 2018 (NC2017/003), following the initial draft ACHA consultation period. As the South Coast People Claimants were not identified during the registration period for the Project and also one of the applicants of the Native Title Claim was already registered as a RAP for the Project, no additional consultation with the South Coast People Claimants was undertaken.

Walnuja

BCD stated:

The ACHAR refers to a RAP called Walnuja (Niche 2019, p.15). Walnuja is not listed in either Table 1 (Summary of RAPs) or the letter with the notification of the RAPs that was provided to OEH. Niche should clarify this RAP and amend the ACHAR as required.

Written correspondence was provided to Walnuja providing a notification of the Project and requesting they provide confirmation of their interest to register as a RAP. Walnuja did not respond and therefore were not registered.

However, a representative of Walnuja attended the draft ACHA information session held on 22 January 2018, accompanying a RAP. Responses to comments from the representative of Walnuja during the information session were incorporated in the ACHA. They did not request to be included as a RAP or provided any further correspondence.

References

- Independent Expert Panel for Mining in the Catchment (2019a). *Initial report on specific mining activities at the Metropolitan and Dendrobium coal mines*. Prepared for the NSW Department of Planning, Industry and Environment.
- Independent Expert Panel for Mining in the Catchment (2019b). *Report of the Independent Expert Panel for Mining in the Catchment: Part 2 – Coal Mining Impacts in the Special Areas of the Greater Sydney Water Catchment*. Prepared for the NSW Department of Planning, Industry and Environment.
- Keith (2007). *Plant Functional Types can predict decade-scale changes in fire-prone vegetation*. Journal of Ecology 95, 1324-1337.
- Mine Subsidence Engineering Consultants (2019a). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Influence of longwall void width on the predicted subsidence effects*. Letter report prepared for South32.
- Mine Subsidence Engineering Consultants (2019b). *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 Biodiversity Offset Strategy*.
- Niche Environment and Heritage (2020). *Dendrobium Mine – Plan for the Future: Coal for Steelmaking Supplementary Biodiversity Assessment Report*.
- Office of Environment and Heritage (2014). *NSW Biodiversity Offset Policy for Major Projects*.
- Office of Environment and Heritage (2016a). *Addendum to NSW Biodiversity Offsets Policy for Major Projects: Upland swamps impacted by longwall mining subsidence*.
- Office of Environment and Heritage (2016b). *Credit Calculator for Major Projects and BioBanking: Operational Manual*.
- South32 Limited (2016). *Dendrobium Area 3B Swamp Rehabilitation Research Program*.
- South32 (2018). *Dendrobium Mine Bushfire Management Plan*.
- South32 Limited (2019a). *Watercourse Impact Monitoring, Management and Contingency Plan*.
- South32 Limited (2019b). *Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan*.
- Watershed HydroGeo (2019). *Geographic review of mining effects on Upland Swamps at Dendrobium Mine*.

ENCLOSURE 2

DENDROBIUM MINE – PLAN FOR THE FUTURE: COAL FOR STEELMAKING
SUPPLEMENTARY BIODIVERSITY ASSESSMENT REPORT (NICHE, 2020)

Dendrobium Mine – Plan for the Future: Coal for Steelmaking Supplementary Biodiversity Assessment Report

Prepared for Illawarra Coal Holdings Pty Ltd (Illawarra Coal) – South32 Limited | 3 July 2020



Document control

Project number	Client	Project manager	LGA
3365	Illawarra Coal Holdings Pty Ltd (Illawarra Coal) – South32 Limited	Simon Tweed/Luke Baker	Wollongong City Council, Wingecarribee Shire Council, Wollondilly Shire Council

Version	Author	Review	Status	Comments	Date
D1	Simon Tweed & Luke Baker		Draft 1		23 June 2020
Final	Simon Tweed & Luke Baker		Final		03 July 2020

© Niche Environment and Heritage Pty Ltd (ACN 137 111 721) 2019

Copyright protects this publication. All rights reserved. Except for purposes permitted by the Australian Copyright Act 1968, reproduction, adaptation, electronic storage, transmission and communication to the public by any means is prohibited without our prior written permission. Any third party material, including images, contained in this publication remains the property of the specified copyright owner unless otherwise indicated, and is used subject to their licensing conditions.

Important information about your Report

Your Report has been written for a specific purpose: The Report has been developed for a specific purpose as agreed by us with you and applies only for that purpose. Unless otherwise stated in the Report, this Report cannot be applied or used when the nature of the specific purpose changes from that agreed. **Report for the sole benefit of Niche's client:** This Report has been prepared by Niche for you, as Niche's client, in accordance with our agreed purpose, scope, schedule and budget. This Report should not be applied for any purpose other than that stated in the Report. Unless otherwise agreed in writing between us, the Report has been prepared for your benefit and no other party. Other parties should not and cannot rely upon the Report or the accuracy or completeness of any recommendation. **Limitations of the Report:** The work was conducted, and the Report has been prepared, in response to an agreed purpose and scope, within respective time and budget constraints, and possibly in reliance on certain data and information made available to Niche. The analyses, assessments, opinions, recommendations, and conclusions presented in this Report are based on that purpose and scope, requirements, data, or information, and they could change if such requirements or data are inaccurate or incomplete. **No responsibility to others:** Niche assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with, or conclusions expressed in the Report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with, or conclusions expressed in the Report.

Niche Environment and Heritage Pty Ltd (ACN 137 111 721)
Enquiries should be addressed to Niche Environment and Heritage
PO Box 2443, Parramatta NSW 1750, Australia
Email: info@niche-eh.com

Glossary and list of abbreviations

Term or abbreviation	Definition
BARBOS	Biodiversity Assessment Report and Biodiversity Offset Strategy (Niche 2018)
BC Act	Biodiversity Conservation Act 2016
BCD	Biodiversity Conservation Division
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPIE	NSW Department of Planning, Industry and Environment
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FL	Total Fallen Logs
NSR	Native species richness
NOS	Native overstorey cover
NMS	Native midstorey cover
NGCG	Native ground cover (grasses)
NGCS	Native ground cover (shrubs)
NGCO	Native ground cover (other)
NTH	No. Trees with Hollows
OR	Overstorey Regeneration
PCT	Plant Community Type
RTS	Response to Submissions
TEC	Threatened Ecological Community

Table of Contents

Glossary and list of abbreviations	i
1. Introduction	1
1.1 Background	1
1.2 Refinement of Development Footprint	2
2. Assessing Native Vegetation and Threatened Flora	4
2.1 Overview	4
2.2 Vegetation mapping	4
2.3 Threatened Flora	7
3. Assessing Threatened Fauna and Populations	8
3.1 Overview	8
3.2 Threatened Fauna Survey	8
3.3 Fauna Survey Methods	8
3.4 Fauna Survey Results	12
4. Update to Biodiversity Offset Requirement	14
4.1 Introduction	14
4.2 Quantifying Offset Impacts – Vegetation Impacts	14
4.3 Quantifying Offset Impacts – Threatened Flora Impacts	14
4.4 Quantifying Offset Impacts – Threatened Fauna Impacts	14
5. References	16
Figures	17
Annexure 1. Vegetation Plot and Transect Results	39
Annexure 2. Fauna Species List	47
Annexure 3. Response Table – Relevant BCD Comments	48

List of Figures

Figure 1. Disturbance Areas (West).....	17
Figure 2. Disturbance Areas (East)	17
Figure 3. Vegetation Mapping and Flora Plots (West)	17
Figure 4. Vegetation Mapping and Flora Plots (East)	17
Figure 5. Flora and Fauna Targeted Survey Methods (West).....	17
Figure 6. Flora and Fauna Targeted Survey Methods (East)	17
Figure 7. Dendrobium Pit Top Car Park	17
Figure 8. Results – Threatened Species (West)	17
Figure 9. Results – Threatened Species (East)	17
Figure 10. Results – Tree Hollow Mapping (West)	17
Figure 11. Results – Tree Hollow Mapping (East).....	17
Figure 12. Koala Species Polygon (West).....	17
Figure 13. Koala Species Polygon (East)	17
Figure 14. Eastern Pygmy Possum Species Polygon (West)	17
Figure 15. Eastern Pygmy Possum Species Polygon (East)	17
Figure 16. Rosenbergs Goanna Species Polygon (West)	17
Figure 17. Rosenbergs Goanna Species Polygon (East).....	17

List of Tables

Table 1. Summary Table of Refined Footprint.....	3
Table 2. Direct Vegetation Disturbance Associated with Proposed Transmission line.....	5
Table 3. Vegetation disturbance at the Ventilation Shaft Sites	6
Table 4. Summary of direct impacts associated with surface infrastructure	6
Table 5: Target species for fauna survey	8
Table 6. Summary of survey effort	9
Table 7. Results of threatened species survey and species polygons	13
Table 8. Ecosystem Credits Required for the Project	15
Table 9. Threatened fauna species credits.....	15
Table 10. Plots Completed within the Transmission Line Easement.....	39
Table 11. BioBanking Transect Results	39
Table 12. Flora Results.....	40
Table 13. Fauna Species List	47

1. Introduction

1.1 Background

The development application for the Dendrobium Mine Extension Project (the Project) is currently being assessed by the NSW Department of Planning, Industry and Environment (DPIE). In March 2020 the South East Branch of the Biodiversity and Conservation Division (BCD) reviewed a Response to Submissions (RTS) prepared by Illawarra Coal Holdings Pty Ltd (Illawarra Coal) – South32 Limited. A number of outstanding issues were raised within the BCD review (Attachment A - Dendrobium mine extension Response to Submissions - Key Issues from EES submission 20 Sept 2019), regarding biodiversity impacts that required additional assessment or clarification.

This supplementary report seeks to address a number of aspects raised by BCD within their review (March 2020) pertaining to ecological survey effort, impact assessment and offsetting considerations.

In response to BCD's comments regarding 'fixing' the locations of infrastructure for which a disturbance allowance was proposed in the Environmental Impact Statement (EIS), the report assesses the confirmed locations of the proposed electricity transmission line (ETL) and service boreholes. This has resulted in a refinement of disturbance for the Project, however there is no increase in the total surface disturbance. The refinement has resulted in a reduction in disturbance of Shale Sandstone Transition Forest Threatened Ecological Community (TEC) (from 1.5 hectares [ha] to 0.55 ha).

In addition, the report details additional surveys performed within proposed ventilation shaft sites and along the proposed ETL (that would service those ventilation shaft sites) that address BCD comments relating to survey effort and assessment in regard to several target fauna species (Powerful Owl, Koala and Eastern Pygmy Possum).

This report updates the biodiversity offset liability associated with the additional biodiversity surveys and confirmed locations of some surface infrastructure, namely:

- An update of the biodiversity offset liability for native vegetation associated with the ETL design and ventilation shaft layout.
- An update of the biodiversity offset, incorporating results from additional survey effort, associated with threatened flora and fauna.

The report also provides a detailed response to the BCD comments.

1.2 Refinement of Development Footprint

1.2.1 Ventilation Shaft Site Design Refinement

The ventilation shaft site layout and infrastructure were described in the Section 3.4.3 of the EIS as below:

The Project would involve the development of the following ventilation infrastructure (Figure 3-3):

- *an additional ventilation shaft site to support Area 5 (Site No 5A) (maximum disturbance of approximately 7.5 ha);*
- *an optional additional ventilation shaft site to support Area 5 (Site No 5B) (maximum disturbance of approximately 3 ha); and*
- *two additional ventilation shaft sites to support Area 6 (Site No 6A and Site No 6B) (maximum disturbance of approximately 4 ha each).*

Since that time, the concept design for Ventilation Shaft Site 5A has been further developed by South32 (Figure 1). Ventilation Shaft Site 5A is scheduled for construction to commence in 2021 and the proposed disturbance area has been increased to approximately 15 ha in order to optimise the site to efficiently and effectively service the Area 5 mining activities. The main design features that require the additional footprint on this site include:

1. The requirement for both an upcast and downcast shaft co-located at the site, and to be constructed simultaneously, and corresponding spoil emplacement for two shafts.
2. The co-location of service boreholes at the site, to provide electricity, mine water (for gas drainage plant and firefighting), compressed air, communications, gas drainage (x 2), tube bundle (on line gas monitoring), rather than being dispersed across the landscape as allowed for in the EIS.
3. The co-location of the gas management infrastructure (including flares, pumps, nitrogen tanks, gas monitoring, water collection, surface pipes and other ancillary infrastructure).
4. Larger sediment basin sized for the increased footprint to capture the recommended design rainfall event outlined in the “Blue Book” (Landcom, 2004).

The design refinement and optimisation of Ventilation Shaft Site 5A has the following environmental benefits:

1. The co-location of service boreholes reduces fragmentation of the landscape that would otherwise be required if service boreholes were dispersed. A total of 5 ha of native vegetation clearing was assessed in the EIS and that disturbance will now be fixed at Site 5A.
2. The co-location of service boreholes avoids the requirement to clear up to approximately 1 ha of the Shale Sandstone Transition Forest TEC that was allowed for in the EIS.
3. The co-location of both upcast and downcast shafts reduces the vegetation clearing required at Ventilation Shaft Site 5B, which was assessed as requiring 3 ha of clearing in the EIS. Ventilation Shaft Site 5B is not proposed to require more than 0.5 ha of vegetation clearing, as the major ventilation infrastructure to support Area 5 will be located at Ventilation Shaft Site 5A.

Compared to the EIS proposal, the design refinements would result in the same total area of vegetation disturbance (i.e. 28.5 ha) with reduced fragmentation and reduced impact on the Shale Sandstone Transition Forest TEC.

1.2.2 Electricity Transmission Line Design Refinement

The ETL was described in the EIS and an allowance of up to 4.5 ha of native vegetation clearing was assessed, including allowance for 0.5 ha of Shale Sandstone Transition Forest TEC. Since lodgement of the Project EIS the concept design alignment has been confirmed by South32 (refer Figure 1 and Figure 2). The ETL is required to service proposed ventilation shafts and underground infrastructure as outlined in the EIS and construction of the ETL would be staged accordingly with indicative timing of ETL sections as follows:

1. Connection point to Ventilation Shaft Site 5A – Construction commencing in 2021 (to service mining in Area 5).
2. Ventilation Shaft Site 5A to Ventilation Shaft Site 5B – approximately 2030, if required.
3. Fire Trail 6 to Ventilation Shaft Site 6B – approximately 2042 (to service mining in Area 6).

The ETL concept design originates at a connection point from an existing Endeavour Energy transmission line located approximately 200 m north west of the Cordeaux Dam Wall. (Figure 2). This connection point is being designed in consultation with Endeavour Energy.

The ETL to Ventilation Shaft Site 5A has been designed to avoid clearing where practical by utilising existing road verges and fire breaks along Fire Trail 6. An easement width of 18 metres (m) (9 m either side of the power pole) is assumed, consistent with design advice from Endeavour Energy. Power pole foundations (spaced approximately every 100 m or closer on curved sections) are proposed to be bored and concreted to a diameter of approximately 1 m. Much of the route is within road verge/fire break that is routinely slashed by WaterNSW.

The future extension of the ETL to Ventilation Shaft Site 5B would seek to avoid clearing by utilising road verges and fire breaks along Fire Trail 6B (Figure 1).

Note that the ETL design for the section from Fire Trail 6 to Ventilation Shaft Site 6B is proposed to be trenched and cabled underground within the 330 kV Transgrid easement south of the creek. This is to avoid vegetation clearing (Figure 2).

1.2.3 Summary of Biodiversity Impacts in BARBOS compared to Refined Footprint

As shown in Table 1, the total area of direct clearing to native vegetation is 28.5 ha. The total calculated impact area from surface infrastructure as described in the Niche (2019) *Biodiversity Assessment Report and Biodiversity Offset Strategy* (BARBOS) has not changed as a result of the refined development footprint.

Table 1. Summary Table of Refined Footprint

Site	Area of Native Vegetation Impacted (ha) as per BARBOS	Proposed Vegetation Impacts (ha)
Ventilation Site No 5A (now includes service boreholes)	7.5	15.0 (now includes service boreholes)
Ventilation Site No 5B	3.0	0.5
Ventilation Site No 6A	4.3	4.3
Ventilation Site No 6B	4.0	4.0
Pit Top Carpark	0.2	0.2
Additional Service Boreholes (EIS did not propose a fixed location)	5	0 (included in Site No 5A)
Electricity Transmission Lines (to Ventilation Shaft Sites) (EIS did not propose a fixed location)	4.5	4.5 (‘fixed’ location)
Total	28.5	28.5

2. Assessing Native Vegetation and Threatened Flora

2.1 Overview

This section details the survey methods and effort used to map vegetation and detect threatened flora within selected parts of the study area in response to submissions, or updates to the location and nature of ancillary infrastructure. The original ecological surveys performed for the Project are described and documented within the BARBOS (Niche 2019).

2.2 Vegetation mapping

The methodology associated with the vegetation mapping for the Project has been described in the BARBOS (Niche 2019). This report also provides mapping for the proposed transmission line easement and associated biodiversity credits. Field verification therefore focused on the following key areas:

- Vegetation mapping and impact assessment of the proposed transmission line easement.
- Updates to the vegetation impacts associated with other surface infrastructure (i.e. the ventilation shaft sites).

2.2.1 Vegetation mapping within the transmission line easement

To determine the extent and type of native vegetation within the proposed transmission line easement, South32 provided Niche with the proposed alignment boundary as a spatial file, which was imported into ArcGIS. A preliminary desktop vegetation map was then completed by analysing the shapefile at a scale of approximately 1:300 against aerial imagery. Polygons representing areas of remnant vegetation and areas of regenerating vegetation (native vegetation that is maintained along the Fire Road easement) were assigned based on the aerial interpretation and analysis process.

The field team (which included a BAM Accredited Assessor) validated the preliminary vegetation mapping, recorded fauna habitat (e.g. hollow-bearing trees) and searched for threatened flora within the transmission line alignment over the course of 7 field days, specifically:

- 13-15th of May 2020.
- 19th of May 2020.
- 21st May 2020.
- 29th June and 1st July 2020.

The field survey involved the completion of 12 BioBanking plots/transects amongst appropriate vegetation zones impacted by proposed transmission line easement as per the requirements of the FBA for each vegetation zone. The number of plots completed within each zone along with the raw flora data has been provided in Annexure 1.

The field analysis confirmed the presence of three Plant Community Types (PCTs) along the alignment, which are comprised of two condition classes:

- Good: vegetation that was in benchmark condition.
- Regeneration: areas of vegetation along the existing fire road/trail easements that are slashed on a regular basis.

The area of proposed disturbance associated with each of the PCTs and condition classes is provided in Table 2, and the location is shown on Figure 3 and Figure 4.

The total area of confirmed native vegetation disturbance for the proposed transmission line is approximately 4.5 ha (Table 2) which is consistent with the 4.5 ha allowance assumed to be directly impacted in the Project BARBOS.

The area of direct impact associated with the transmission line would encompass:

- A total of approximately 250 poles to be installed directly into the ground. The installation would be done via machine auger, and require an area of approximately 2 x 2 m for the installation process. Power pole foundations are proposed to be bored and concreted to a diameter of approximately 1 m. The actual disturbance areas would be the width of the pole (approximately 1 m²), however to provide a conservative impact area, we have assumed a total of 0.2 ha of impact as shown in Table 2 to account for the installation of the poles.
- Clearing of remnant vegetation (canopy, mid canopy and shrubs) to create a 18 m wide easement along the transmission line traverse.

We have assumed that the easement required for the proposed transmission line would not require the clearing of the maintained/regenerating vegetation that is currently within the Fire Road easement. The vegetation that exists along the Fire Road easement is maintained at a low height (typically below 0.5 m) by WaterNSW to act as a fire break. This maintenance regime will therefore continue, and thus not result in direct clearing.

Table 2. Direct Vegetation Disturbance Associated with Proposed Transmission line

Plant Community Type (PCT)	Condition	Area of impact (ha) for the transmission line easement	Area of impact for the installation of power poles	Total (ha)
1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (HN566)	Moderate/Good	3.00	0.00	3.10
	Regeneration	0.00	0.10	
1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (HN556)	Moderate/Good	0.45	0.00	0.55
	Regeneration	0.00	0.10	
1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (HN651)	Moderate/Good	0.85	0.00	0.85
Total		4.3	0.2	4.5

NB: The 'Regeneration' condition class in the table above is represented as Moderate/Good_High within the Biobanking Calculator and relevant exports due to limitations within the calculator regarding condition labels. This also applies to the remainder of this report.

2.2.2 Vegetation mapping within the Ventilation Shafts

Vegetation mapping of the ventilation shaft sites was completed during the Project BARBOS. As detailed in Table 7 of the BARBOS, a larger area than was required for disturbance was surveyed for each ventilation shaft site to allow for flexibility during the refinement of the ventilation shaft site layouts (Figure 5 and Figure 6). An update of the vegetation mapping therefore was not required as part of this supplementary report as the revised shaft site layouts remain within the originally surveyed areas.

Since the BARBOS was submitted, a refined footprint for Ventilation Shaft Site 5A was provided to Niche (as shown in Figure 1 and Figure 3) which also incorporates service borehole sites. The amount of required clearing within the remaining ventilation shaft sites was also revised, however the exact location of clearing within these sites has yet to be determined. For the purposes of conservatively calculating clearing impacts in vent shaft sites other than Ventilation Shaft Site 5A, all clearing is assumed to be in the good condition vegetation zone. Therefore any change to the location of disturbance within the surveyed areas for the other ventilation shaft sites would not result in a change in the associated offset requirement.

The area of vegetation to be directly impacted by the ventilation shaft sites has been shown in Figure 3 and Figure 4, and includes the areas detailed in Table 3.

Table 3. Vegetation disturbance at the Ventilation Shaft Sites

Plant Community Type (PCT)	Condition	Ventilation Shaft Site No				Total (ha)
		5A	5B	6A	6B	
1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (HN566)	Moderate/Good	13.95	0.5	4.3	4.0	23.8
	Regeneration	1.05	0.0	0.0	0.0	
Total		15.0	0.5	4.3	4.0	23.8

2.2.3 Vegetation mapping within Pit-top Carpark

There is no change from that assessed in the BARBOS. The area of impact has not changed from a total of 0.2 ha of native vegetation that aligns to the PCT1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (HN597).

2.2.4 Summary of direct vegetation impacts associated with surface infrastructure

The amount of vegetation to be directly impacted for the proposed surface infrastructure is 28.50 ha (Table 4). This is consistent with the amount assumed to be impacted in the BARBOS. An update of the biodiversity offset requirement associated with the vegetation impacts has been provided in Section 4 of this report.

Table 4. Summary of direct impacts associated with surface infrastructure

Surface Infrastructure	Native vegetation community							Total
	PCT1083 (HN566) Mod/Good	PCT1083 (HN566) Regen	PCT1250 (HN651) Mod/Good	PCT1250 (HN651) Regen	PCT1395 (HN556) Mod/Good	PCT1395 (HN556) Regen	PCT1245 (HN597) Mod/Good	
Transmission line easement	3.00	0.00	0.85	0.00	0.45	0.00	0.00	4.30
Transmission line pole	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.20
Vent shaft 5A	13.95	1.05	0.00	0.00	0.00	0.00	0.00	15.00
Vent shaft 5B	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Vent shaft 6A	4.30	0.00	0.00	0.00	0.00	0.00	0.00	4.30
Vent shaft 6B	4.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
Pit-top Carpark	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20
Total	25.75	1.15	0.85	0.00	0.45	0.10	0.20	28.50

2.3 Threatened Flora

A threatened flora survey was conducted within the proposed transmission line easement by two ecologists (including a BAM Assessor). A total of 42 hours was completed for threatened flora surveys undertaken on:

- 13-15th of May 2020.
- 19th of May 2020.
- 21st May 2020.

The threatened flora surveys involved walking the entire stretch of the transmission line easement as shown on Figure 5 and Figure 6.

During the field survey, two threatened flora species were recorded:

- *Acacia bynoeana*: A total of 86 plants were recorded within the existing easement along Fire Road 6 (Figure 7). The population occurred within slashed/maintained vegetation within the existing Fire Road 6 easement. This area is managed by WaterNSW on a periodic basis to ensure that the height of the vegetation remains below approximately 0.5 m, and thus acts as a fire break. The existing management practices may have attributed to the plant's establishment given the species is known to prefer disturbed sites such as trail margins (NSW Scientific Committee 1999).
- *Epacris purpurascens* var. *purpurascens*: Three plants were recorded within 5 m of the proposed transmission line easement to Ventilation Shaft Site 6B as shown on Figure 9. All of these plants occur within an existing Transgrid easement that consists of low shrubs and native ground cover. This easement is currently managed by Transgrid for an existing transmission line.

Both recorded threatened flora species would not be directly impacted by the Project due to the following:

- The populations of *Acacia bynoeana* and *Epacris purpurascens* occur within an existing easement that is subject to regular trimming/slashing regimes. The proposed transmission line will not increase the existing management regimes.
- The transmission line pole placements will avoid the species, thus avoiding direct impacts to individual plants.
- The *Epacris purpurascens* plants occur adjacent to rather than within the proposed new transmission line easement.
- The plants would be marked by an ecologist prior to construction works, thus ensuring the species is avoided during construction.
- Contractors would be made aware of the plants prior to any construction activities.

Given both species are considered unlikely to be impacted, no biodiversity offset is required for these species.

3. Assessing Threatened Fauna and Populations

3.1 Overview

This section details the survey methods and effort used to detect threatened fauna and their habitats within selected parts of the study area in response to BCD, or updates to the location and nature of surface infrastructure. The original suite of ecological surveys performed for the Project are described and documented within the BARBOS (Niche 2019).

3.2 Threatened Fauna Survey

Field survey was confined to areas of surface infrastructure where vegetation clearing and habitat removal for proposed ventilation shaft sites and other surface infrastructure is proposed. Target fauna species are tabled below, although the methods and survey effort undertaken are relevant for other potentially occurring threatened species including other species credit species.

Table 5: Target species for fauna survey

Common Name	Scientific Name	Class of Credit (NSW FBA/Biobanking)
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Species
Koala	<i>Phascolarctos cinereus</i>	Species
Powerful Owl	<i>Ninox strenua</i>	Species (breeding)/Ecosystem (foraging)
Littlejohns Tree Frog/Giant Burrowing Frog	<i>Litoria littlejohnii/ Heleioporus australiacus</i>	Species

Field survey was undertaken between the 28th of April 2020 and the 22nd of May 2020 (over 11 days and nights). Additional Koala SAT plots (5) were conducted on the 29th of June and the 1st of July. Conditions during field survey were generally fine with significant rain or wind avoided for on-ground surveys.

The extent of the fauna survey effort is shown on Figure 5 and Figure 6.

3.3 Fauna Survey Methods

Habitat Tree Surveys

Tree hollow surveys were conducted by traversing through the study area, inspecting every angle of the trees present if they were a candidate tree for hollows. The number of hollows present on each tree was recorded, along with size class of hollows in centimetres (0-5, 5-10, 10-15, 15-20, 20-30, >30), height above the ground and the tree species. Stags (dead trees) with hollows were also recorded. Data was collected with a GPS enabled device for later mapping.

All areas where tree clearing is proposed were mapped for hollows.

SAT Plots

Koala scats were searched for using the SAT assessment technique (Phillips and Callaghan 2011). Selected trees to use as centre trees consisted of secondary (*Eucalyptus punctata*) or supplementary (*E. eugenioides*, *E. globoidea*), feed tree species as determined within the Koala Recovery Plan (DECC 2008), noting that primary feed trees were not present at any site. If neither secondary or supplementary trees were available, other listed Koala feed trees (*E. piperita* and *E. sieberi*) according to the Koala Habitat Protection Guideline (DPIE 2020) were used as centre trees.

Table 6. Summary of survey effort

Method	Ventilation Shaft Sites					Other Surface Infrastructure (Areas 5 and 6)	Comments
	5A	5B	6A	6B	Total Ventilation Shaft Survey Effort		
Dusk survey	6 hours performed over 3 nights	4 hours performed over 2 nights	4 hours performed over 2 nights	4 hours performed over 2 nights	18 hours	N/A	Targeted to Powerful Owl and Koala habitat to add certainty around absence of these species within Study Area.
Nocturnal bird call playback	30 minutes performed over course of 3 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	1.5 hours	N/A	At the end of dusk surveys close to large hollow bearing tree areas.
Nocturnal bird day habitat search	Conducted during tree hollow mapping (approx. 3 hours)						Search for potential roost trees for owls, particularly within proposed ventilation shaft sites.
Infrared cameras	9 camera sites. 180 nights	8 camera sites. 160 nights	7 camera sites. 140 nights	7 camera sites. 140 nights	30 cameras for 620 nights	N/A	Target species included the Eastern Pygmy-possum. Cameras were used in preference to Elliot traps due to access to catchment area and efficacy.
Spotlighting surveys – foot arboreal and terrestrial mammals	12 hours performed over 3 nights	8 hours performed over 2 nights	8 hours performed over 2 nights	4 hours preformed over 1 night	32 hours	2 hours effort were spent along the transition forest on Fire Road 6B between Ventilation Shaft Sites 5B and 5A. Additional 4 hours at ETL connection area. 0.5 hours at Pit-top Carpark.	
Spotlighting surveys – vehicle arboreal and terrestrial mammals	-					6 hours over 1 night performed along proposed ETL easement from Ventilation Shaft Site 5B to 6B at walking pace (14.5 km). Intermittently stopping to proceed with 100 m foot-based survey.	
Call-playback surveys– Koala	45 minutes performed within centre of site over course of 3 nights	30 minutes performed within centre of site over course of 2 night	30 minutes performed within centre of site over course of 2 nights	30 minutes performed within centre of site over course of 2 nights	2.25 hours combined		
Search for scats and signs – all mammals	Incorporated into all survey activities.						
Spot Assessment Technique (SAT) - Koalas	3 SAT plots	2 SAT plots	2 SAT plots	2 SAT plots	9 SAT plots (12 SAT plots combined with 2019 efforts)	5 SAT plots within PCT 1083 - Red Bloodwood - scribbly gum heathy woodland. 1 SAT plot conducted in 1395 Narrow- leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest to act as a reference site.	Presence is assumed or was previously verified within all PCTs except for PCT 1083 - Red Bloodwood - scribbly gum heathy woodland, which was the focus of additional survey.

Method	Ventilation Shaft Sites					Other Surface Infrastructure (Areas 5 and 6)	Comments
	5A	5B	6A	6B	Total Ventilation Shaft Survey Effort		
Song Meter recording – Koalas/Owls	1 song meter unit. 21 nights	1 song meter unit. 21 nights	1 Song meter unit. 15 nights	1 Song meter unit. 15 nights	4 Song meter units. Combined effort of 72 trap nights	N/A	Central location within site boundary, close to large hollow bearing trees.
Frog nocturnal call playback and watercourse search	30 minutes performed over course of 3 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	20 minutes performed over course of 2 nights	1.5 hours	N/A	Incorporated into nocturnal habitat and watercourse searches as well as dusk survey.

NB: hours are total person hours rather than necessarily duration of survey.

At each site, the bases (0 to 2 m from the trunk) of thirty trees were searched for evidence of Koala scat by first circling around the tree looking for scats without disturbing the leaf litter (approximately 1 minute), then by raking through the leaf litter for scats (approximately 1 additional minute). Koala scats at any tree were observed and recorded.

Powerful Owl (*Ninox strenua*) Survey including Dusk Watches

Searches for potential breeding trees for the Powerful Owl were conducted at all sites during habitat tree surveys. In addition, pellet searches were performed in combination with SAT plots.

Dusk watches were conducted for at least an hour per survey. The location of dusk surveys was biased towards depressions in areas with large hollow trees at proposed ventilation shaft sites. Spotlighting and call playback was performed immediately after dusk watches. Acoustic recording was also used to target the Powerful Owl (see details below).

Songmeters

Songmeter (SM2+) acoustic recorders were set centrally within vent shaft sites to detect Powerful Owls and Koalas with a recording schedule of 6 hours per night incorporating sunset and sunrise. The detectors were placed on the ground or elevated up to 1 m where possible and, pointed upwards at approximately a 45° angle. Recorded calls were later analysed using Kaleidoscope software.

Spotlighting

Spotlighting (walked) was conducted within each ventilation shaft site and along representative sections of the proposed transmission line. Each spotlighting session consisted of a traverse through the site sampling the identified habitats using bright LED torches. Driven spotlighting transects (approximately 15 km/hr) were completed along any areas of the ETL not walked (14.5 km total).

Frog and Tadpole Surveys

Opportunistic nocturnal and diurnal frog survey was conducted at any identified watercourses during survey for other target species (i.e. along any intermittent creeks within the vent shaft sites). Survey involved listening for frog calls and call playback (nocturnal) as well as active searching of frog habitat (diurnal) during the day, particularly for tadpoles of Littlejohns Tree Frog or the Giant Burrowing Frog.

Reptile Surveys

Reptile surveys were conducted opportunistically where rocky outcrops were identified. Survey involved checking under rock plates and partially embedded rocks.

Nocturnal Call Playback (Mammals and Owls)

Nocturnal call playback was carried out adjacent to or within proposed ventilation shaft sites and areas of potential Koala habitat (as identified by presence of preferred feed tree species). Calls of targeted species (Koala, Powerful Owl) were broadcast for up to five minutes followed by five minutes of listening time after completion of each dusk watch survey. Is this correct.

Cameras

Infrared cameras were deployed throughout each ventilation shaft site to target the Eastern Pygmy-possum. Cameras were focused on flowering shrubs such as *Banksia ericifolia* or *Lambertia formosa*. Baited tubes with a mixture of honey, oats and peanut butter were attached to branches within the field of view of the camera in some cases if flowers were not abundant (approximately half of the cameras).

3.3.1 Pit-top Carpark

Survey was performed at the Pit-top Carpark on the 25th of May 2018 for the Project BARBOS. Further survey was completed on the 11th of May 2020 to confirm the results of the 2018 survey, complete additional spotlight survey (0.5 hours), as well as undertake habitat tree mapping.

3.4 Fauna Survey Results

3.4.1 Tree mapping

Hollow bearing trees and stags were mapped throughout the development area (Figure 10 and Figure 11), indicating high densities of hollow bearing trees of varying size classes within remnant vegetation. The data reinforces data collected within Biobanking plots throughout areas to be cleared (see Appendix 4 of the BARBOS - Niche 2019).

Ventilation Shaft Site 5A contained 218 hollow trees or stags within the area surveyed for tree hollows (13.95 ha) where clearing is to occur amongst vegetation with mature trees. This equates to approximately 1.6 hollow trees per 1,000 m². Biobanking data collected from ventilation shaft sites collectively during the original BARBOS estimated hollow trees at 2.2 per 1,000 m² (data averaged from 14 Biobanking plots).

Despite a high density of hollows throughout ventilation shaft sites, there were very limited sightings/densities of arboreal mammals. This is considered to be a feature of the low nutrient Sandstone Ridgetop Woodland (HN566) areas within the study area. Observations from sightings or heard calls within ventilation shaft sites during spotlighting and other activities consisted of Feathertail Glider (1), Common Ringtail Possum (2) and the Sugar Glider (1). Conversely, in higher nutrient areas of Shale Sandstone Transition Forest TEC, higher densities of arboreal mammals were observed with the Koala (2), Greater Glider (1), Sugar Glider (1) and Common Ringtail Possum (1) being recorded with far more limited survey effort.

3.4.2 Targeted species results

Of the targeted species surveyed for, two were recorded during survey (Figure 8 and Figure 9): the Eastern Pygmy -possum at Ventilation Shaft Sites 5A, 6A and 6B; and the Koala along the Fire Trail 6B ETL route. Details of survey for all target species are provided in Table 7, along with any other threatened species recorded.

3.4.3 Other species

BCD also requested a species polygon be provided for the Rosenbergs Goanna, which was listed as a species credit species at the time of preparation of the Project BARBOS. No additional surveys were required as the species was recorded during surveys for the Project BARBOS (Niche 2019).

A species polygon of 27.05 ha has been prepared which incorporates all areas of vegetation to be cleared with the exception of regenerating areas which are considered to be degraded habitat and all areas of PCT1245: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest (HN 597) areas within the Pit-top Carpark as the species was not linked to this PCT within the Threatened Species Profile Database (TSPD), the habitat present at the site does not suit the species and the species is not known to occur below the top of the escarpment within the locality.

Table 7. Results of threatened species survey and species polygons

Species	Survey Results	Species Polygon
Eastern Pygmy-possum (<i>Cercartetus nanus</i>)	Detected using remote cameras at three of the four ventilation shaft sites on one or two cameras at each site. Two ventilation shaft sites had definitive records of the species while one site had probable records.	A species polygon of 27.25 hectares has been prepared incorporating the entirety of all ventilation shaft sites as well as other areas of proposed clearing where there are flowering shrubs upon which the species is likely to forage (i.e. all areas except slashed road verges), excluding areas of regeneration. Whilst limited habitat is considered to occur within the Pit Top Carpark (due to limited flowering shrubs) this area was included, as the BVT vegetation type is associated with the species within the Biobanking calculator/TSPD.
Koala (<i>Phascolarctos cinereus</i>)	Recorded within areas of Shale Sandstone Transition Forest TEC within the ETL alignment along Fire Trail 6B. The species was spotlighted, heard calling and scat located within these areas. 6 scats were recorded under 30 trees (1 SAT plot) within an area of Shale Sandstone Transition Forest TEC within the ETL alignment. Conversely, no scats were recorded from a search of 270 trees amongst the proposed ventilation shaft site areas; nor was the species recorded during spotlighting or call playback within these areas.	A species polygon of 1.5 hectares has been determined comprising all areas outside of the ventilation shaft sites that are not Sandstone Ridgetop Woodland (HN566) and support trees (either midstorey or canopy - i.e. excluding areas of regeneration). It was demonstrated during targeted ventilation shaft site and ETL surveys that the species is unlikely to use the Sandstone Ridgetop Woodland (HN566) areas except potentially to move through. This is consistent with the outcomes of surveys undertaken for the Project BARBOS. Note where feed tree species listed under the Koala Recovery Plan (DECC 2008) or SEPP 44 were not present within the ventilation shaft sites, feed tree species listed under the updated Koala Habitat Protection Guideline (DPIE 2020) (which accompanies the Koala Habitat Protection SEPP) were used as centre trees for SAT plots. BCD has previously requested HN566 be included in the Koala species polygon due to the presence of feed tree species listed under the Koala Habitat Protection Guideline. No Koalas were recorded during surveys of these trees which confirms species credits are not required for the ventilation shaft sites, consistent with the Project BARBOS.
Powerful Owl (<i>Ninox strenua</i>)	Numerous trees containing hollows of sufficient size for Powerful Owl breeding (i.e. > 20 cm) were recorded with the proposed ventilation shaft sites. Outside of the ventilation shaft sites, two trees containing hollows of sufficient size for Powerful Owl breeding (i.e. > 20 cm) are likely to be cleared for the proposed powerline. The species was not recorded during any surveys including recent targeted survey at ventilation shaft sites. No trees containing hollows of sufficient size for Powerful Owl breeding (i.e. > 20 cm) were identified during mapping undertaken within the Pit-top Carpark area.	A species polygon is not required for the Powerful Owl as although trees containing hollows of sufficient size for breeding were identified, the species was not recorded within the ventilation shaft sites during targeted surveys and mapped trees with suitable hollows were all within the Sandstone Ridgetop Woodland (HN566) vegetation community, which is not listed as Powerful Owl habitat within the Biobanking Calculator/TSPD. Furthermore, landscape position for the ventilation shaft sites does not align with preferred breeding habitat for Powerful Owl.
Greater Glider (<i>Petauriodes volans</i>)	Detected during spotlighting only from areas of Shale Sandstone Transition Forest TEC within the ETL alignment along Fire Trail 6B, consistent with survey undertaken for the Project BARBOS.	A species polygon is not required as the Greater Glider is not listed under the BC Act and considered unlikely to be significantly impacted under the EPBC Act (an Assessment of Significance has been previously undertaken, refer to Appendix 7 of the Project BARBOS).

4. Update to Biodiversity Offset Requirement

4.1 Introduction

The biodiversity offset strategy, including the impact assessment and offset requirement associated with subsidence impacts to Coastal Upland Swamps, has been provided in the BARBOS. This report focuses on the refinement of the biodiversity offset liability associated with changes to the surface infrastructure footprints/design, namely:

- An update of the biodiversity offset to native vegetation associated with the transmission line design, and ventilation shaft layout.
- An update of the biodiversity offset, incorporating additional survey effort, associated with threatened fauna as a result of the revised ventilation shaft layout, transmission line easement and the proposed carpark.

We have included the entire offset liability (i.e. surface infrastructure impacts and subsidence impacts) within the tables of this section, however it is recommended that the BARBOS be referred to if further detail is required regarding subsidence impacts, which have not changed as a result of the additional survey.

4.2 Quantifying Offset Impacts – Vegetation Impacts

The FBA identifies the BioBanking Credit Calculator (BBCC) as the appropriate tool for quantifying offsets required in both ecosystem and species credit terms. Details regarding the landscape assessment and processes undertaken to establish the BBCC case file are contained within the Project BARBOS.

Through the refinement of the transmission line and revised footprint for the ventilation shaft sites, the BBCC case file submitted with the BARBOS has been updated to reflect:

- Revision of areas of vegetation directly impacted by the Project (Table 4).
- Incorporation of the BAM plot data obtained along the transmission line easement.

The ecosystem credit requirement generated for direct impacts from surface infrastructure are listed in Table 8. The table also includes the biodiversity credits for the subsidence impacts to Coastal Upland Swamps which has been detailed in the BARBOS and has not changed as a result of additional survey.

4.3 Quantifying Offset Impacts – Threatened Flora Impacts

No threatened flora are likely to be directly impact by the surface infrastructure (Section 2.3). There is therefore no change to the conclusions provided in the BARBOS. An offset associated with threatened flora is therefore not required.

4.4 Quantifying Offset Impacts – Threatened Fauna Impacts

Species polygons have considered the revised areas of impacts for the surface infrastructure and results of additional targeted survey, as well as the subsidence impacts detailed in the BARBOS which have not changed.

The updated area of impact to each of the species based on the surface infrastructure refinement, along with the subsidence impacts as per the BARBOS, has been provided in Table 9.

Table 8. Ecosystem Credits Required for the Project

BVT	Plant Community Type (PCT)	Updated Area of Impact (ha)	Updated Ecosystem Credit Requirement	Change in Area of Impact from EIS (ha)	Change in Ecosystem Credit Requirement from EIS	Impact Mechanism
HN566	1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	26.9	1,051	+1.1	+29	Surface Disturbance - ventilation shaft sites and ETL alignment
HN556	1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	0.55	40	-0.95	-80	
HN651	1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	0.85	68	-0.15	-12	
HN597	1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	0.20	6	-	-	Surface Disturbance – Pit Top Carpark
HN560	978 Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion	16.30	227	-	-	Subsidence – Coastal Upland Swamps
HN662	1804 Needlebush - Banksia wet heath swamps on coastal sandstone plateaux of the Sydney basin	4.57	78	-	-	

Table 9. Threatened fauna species credits

Common name	Scientific name	Updated Species Polygon (ha)	TS offset multiplier	Updated Species Credit Requirement	Change in Species Polygon from EIS (ha)	Change in Species Credit Requirement from EIS	Impact Mechanism
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	27.05	3.3	893	27.05	893	Surface Disturbance – ventilation shaft sites and ETL alignment
Koala	<i>Phascolarctos cinereus</i>	1.5	2.6	39	-	-	Surface Disturbance – Pit-top Carpark and ETL alignment
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	27.25	2.0	545	27.25	545	Surface Disturbance – Pit-top Carpark, ventilation shaft sites and ETL alignment
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	32.74	1.3	426	-	-	Subsidence – streams and upland swamps
Littlejohn's Tree Frog	<i>Litoria littlejohni</i>	32.74	2.6	851	-	-	
Giant Dragonfly	<i>Petalura gigantea</i>		7.7	1073			Subsidence – upland swamps with breeding and foraging habitat
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	0.28	3.3	9	-	-	Subsidence – cliff lines
Red-crowned Toadlet	<i>Pseudophryne australis</i>		1.3	94			Subsidence – streams

5. References

DECC 2008. Approved Recovery Plan for the Koala (*Phascolarctos cinereus*). State of NSW and the Department of Environment and Climate Change NSW.

Niche 2019. Biodiversity Assessment Report and Biodiversity Offset Strategy, Dendrobium Mine – Plan for the Future: Coal for Steelmaking, Prepared for South32 Illawarra Coal.

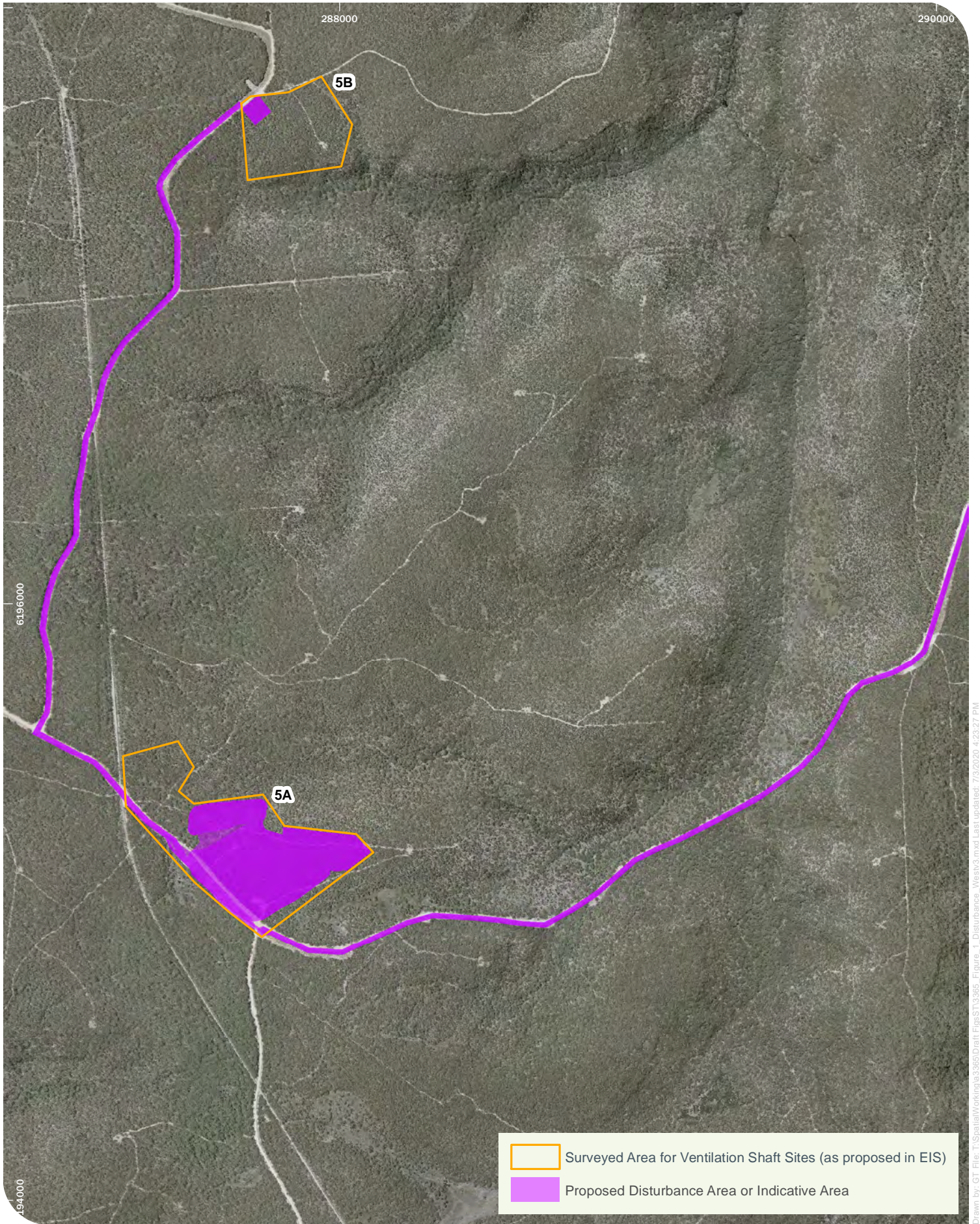
DPIE 2020. Koala Habitat Protection Guideline: Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019. Accessed online: <https://www.planningportal.nsw.gov.au/draftplans/under-consideration/koala-habitat-protection-guideline>

Landcom 2004. Managing Urban Stormwater: Soils & Construction, Volume 1.

NSW Scientific Committee 1999. *Acacia bynoeana* (a shrub) - Endangered species determination - final.

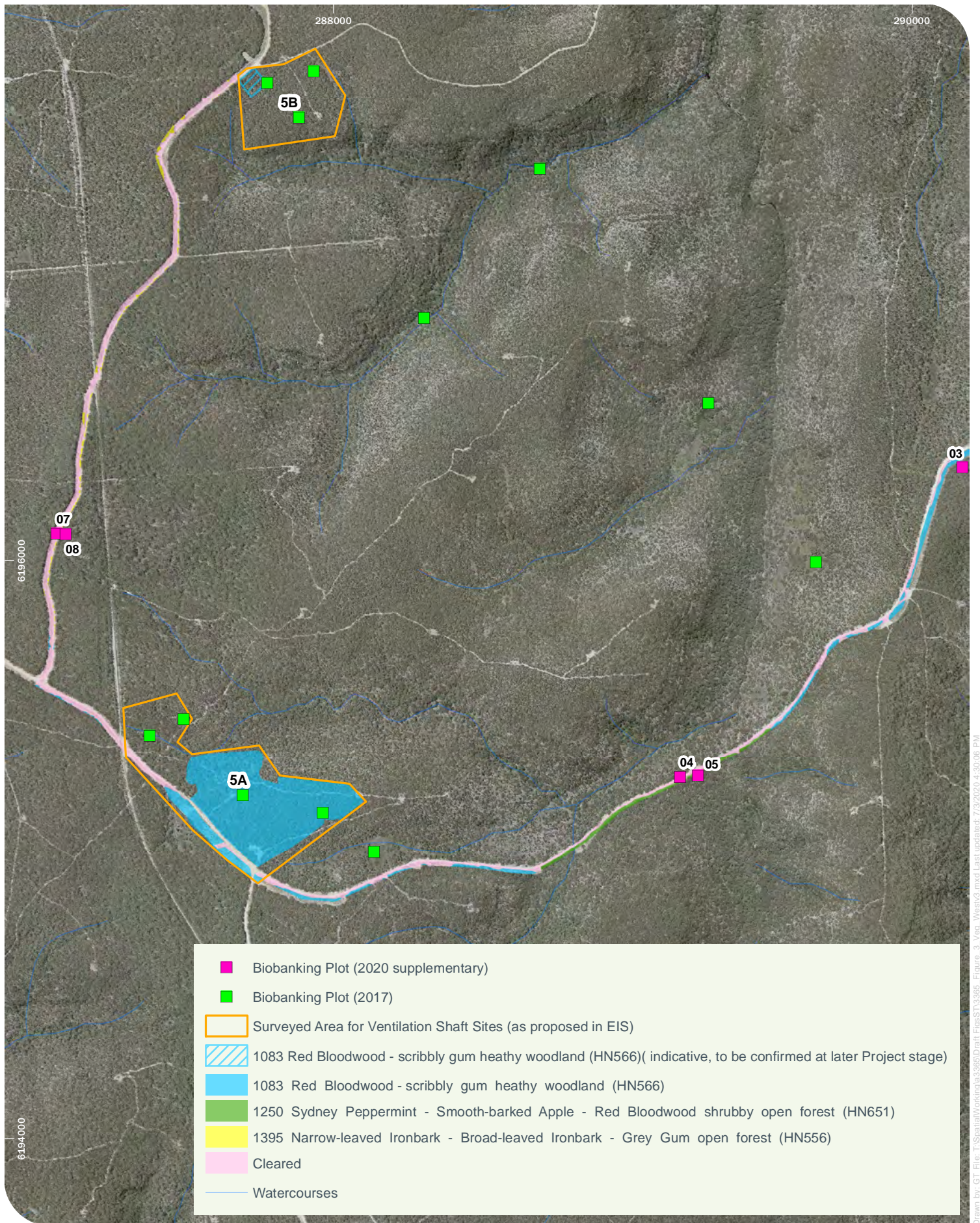
Phillips, S, & Callaghan, J. 2011. The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas *Phascolarctos cinereus*. Australian Zoologist, 35(3), 774-780. Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2011.

Figures

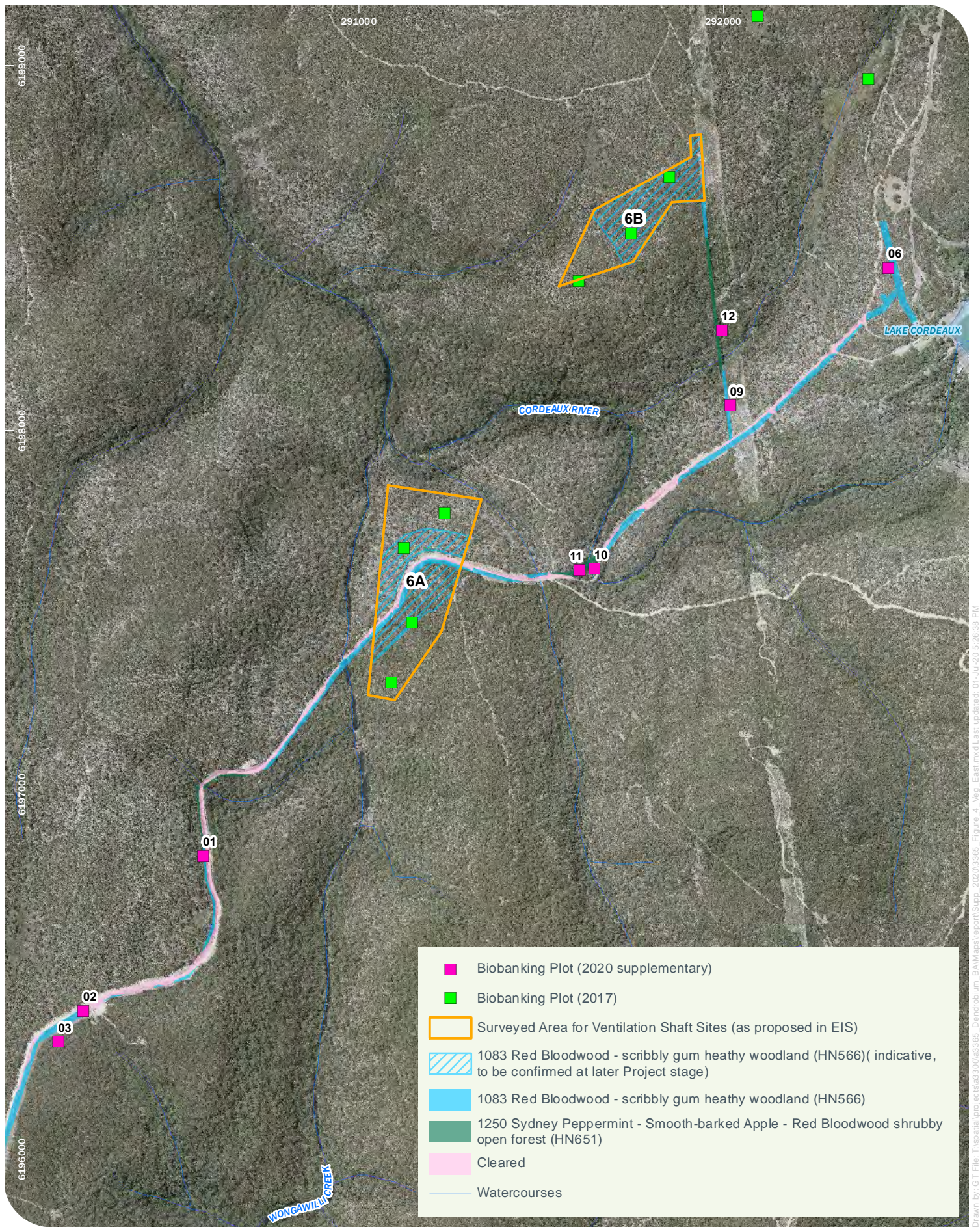


Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_1_Disturbance_West.v3.mxd Last updated: 7/3/2020 4:23:27 PM

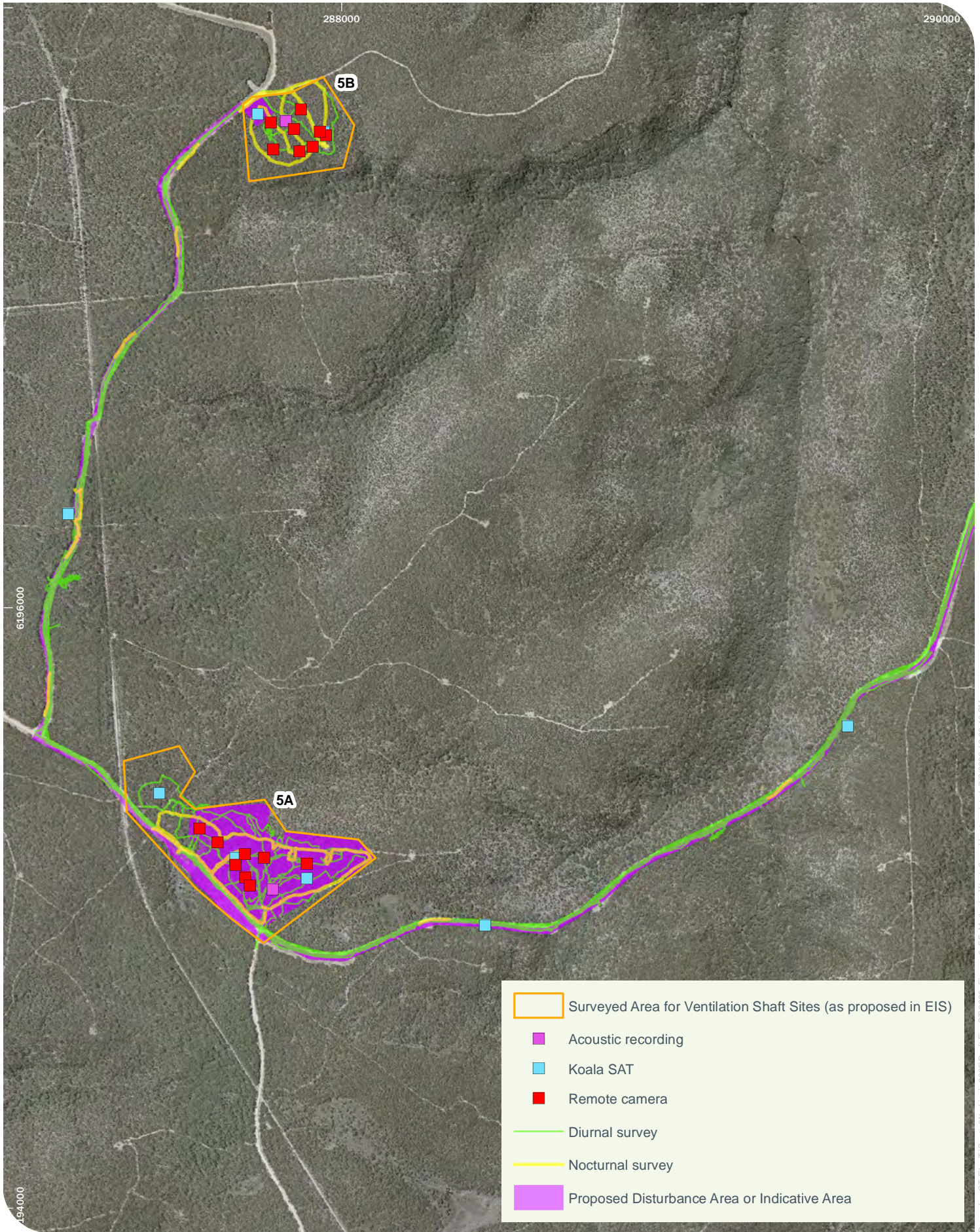




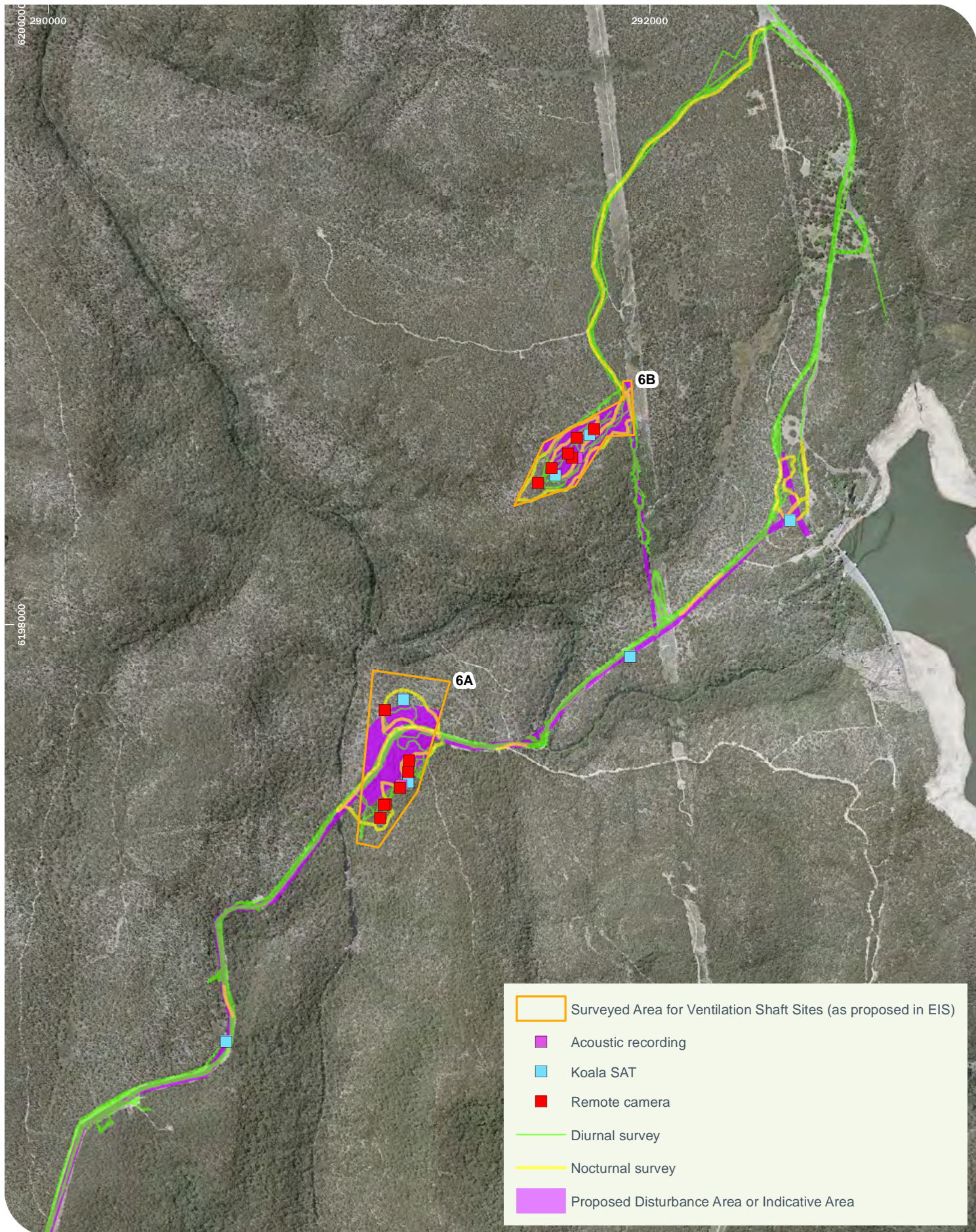
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\ST3365_Figure_3_Veg_West3.mxd Last updated: 7/9/2020 4:30:06 PM



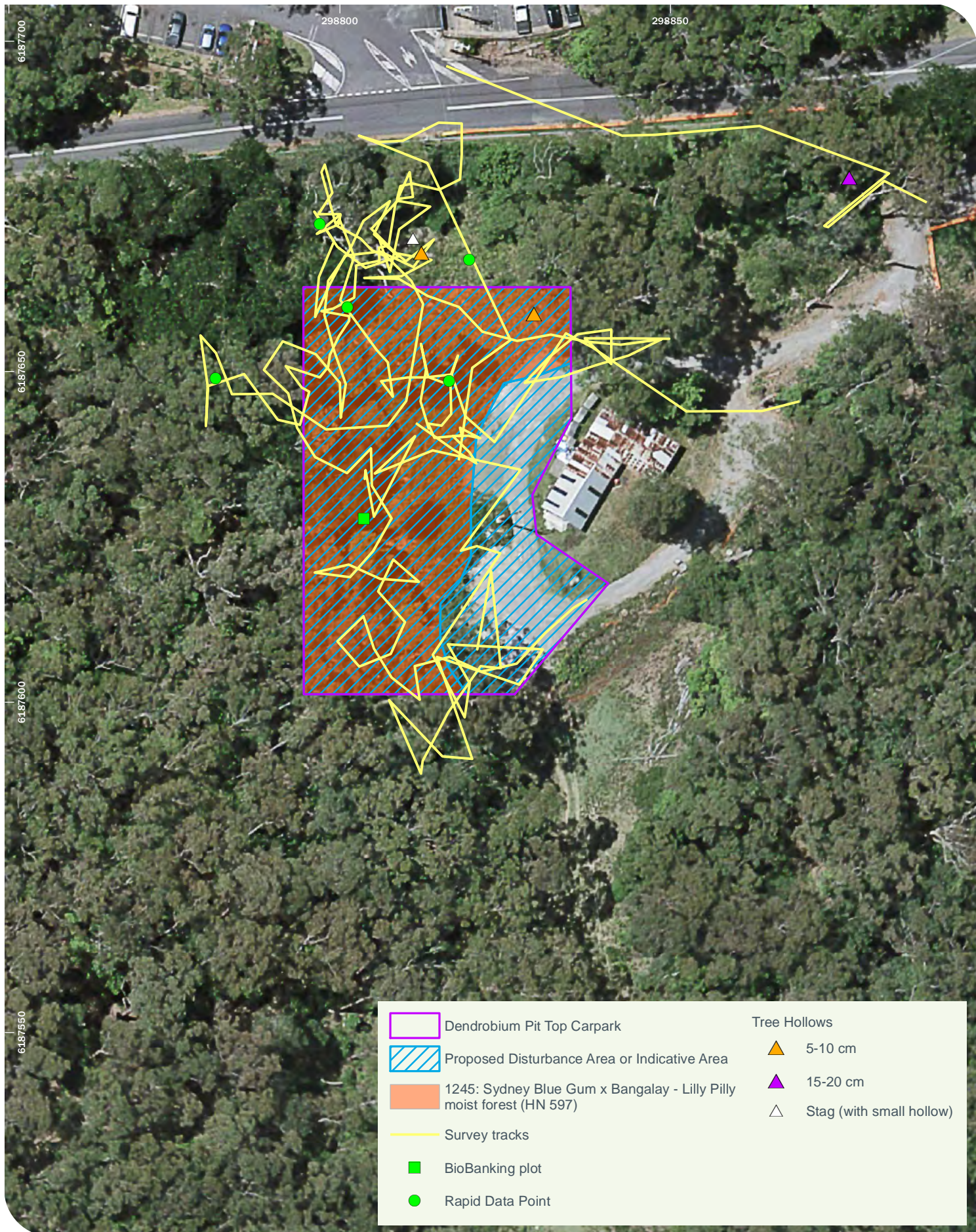
Drawn by: G.T File: T:\spatial\projects\3300\3365_Dendrobium_BA\Map\report\Supp_2020\3365_Figure_4_Veg_East.mxd Last updated: 01-Jul-20 5:26:38 PM



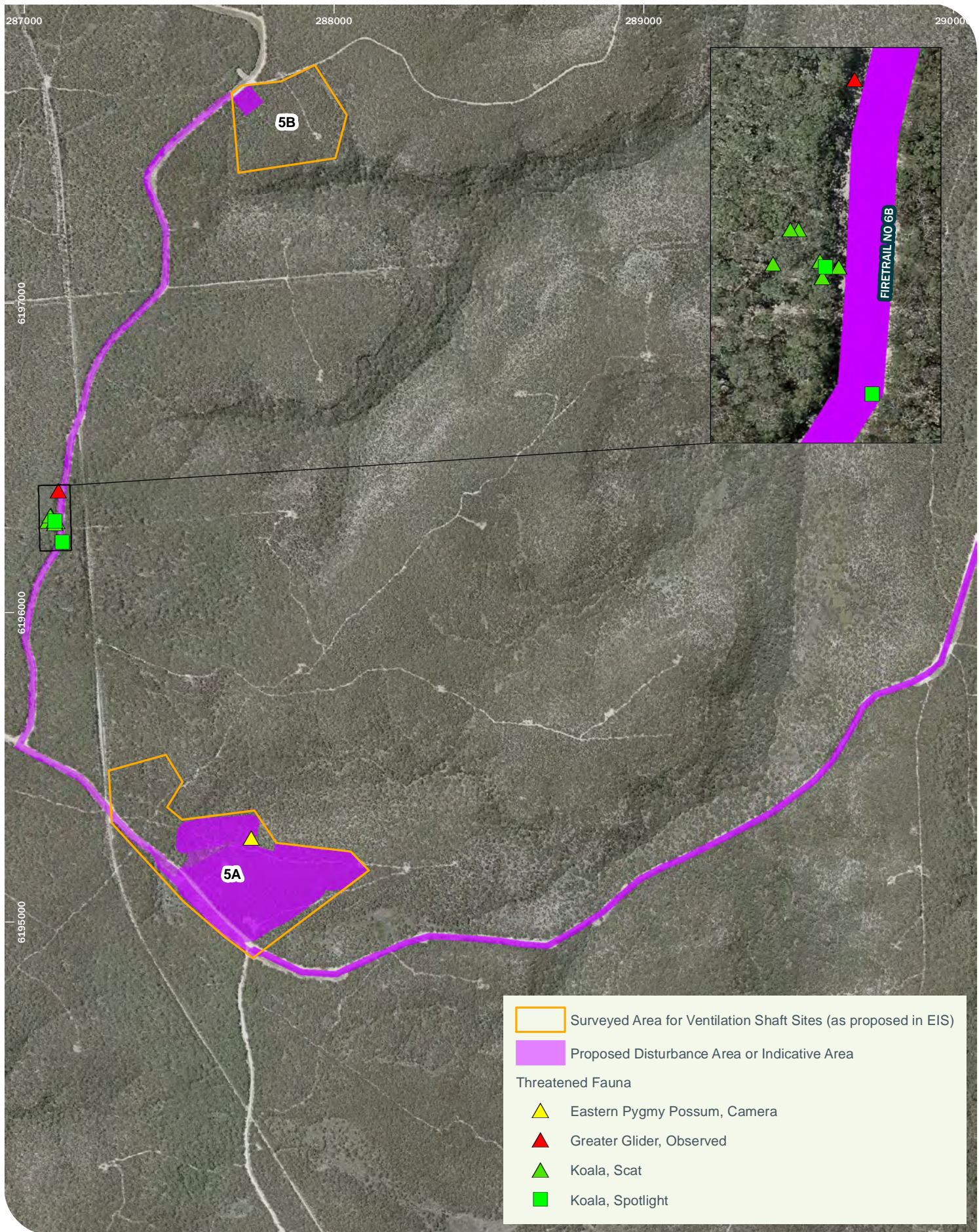
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_5_FF_Methods_Westv2.mxd Last updated: 7/9/2020 12:03:12 PM



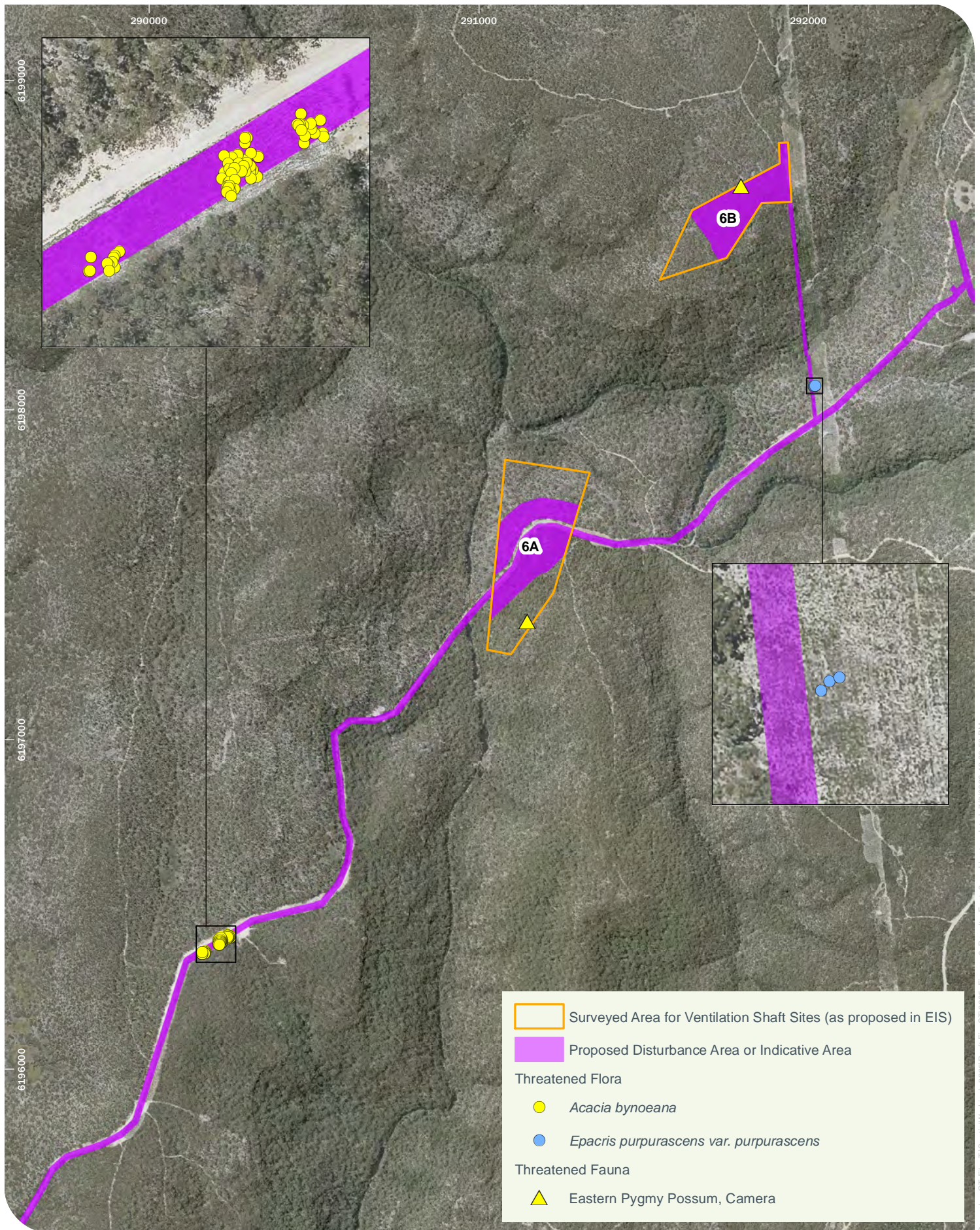
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_6_FF_Methods_Eastv2.mxd Last updated: 7/9/2020 12:05:27 PM



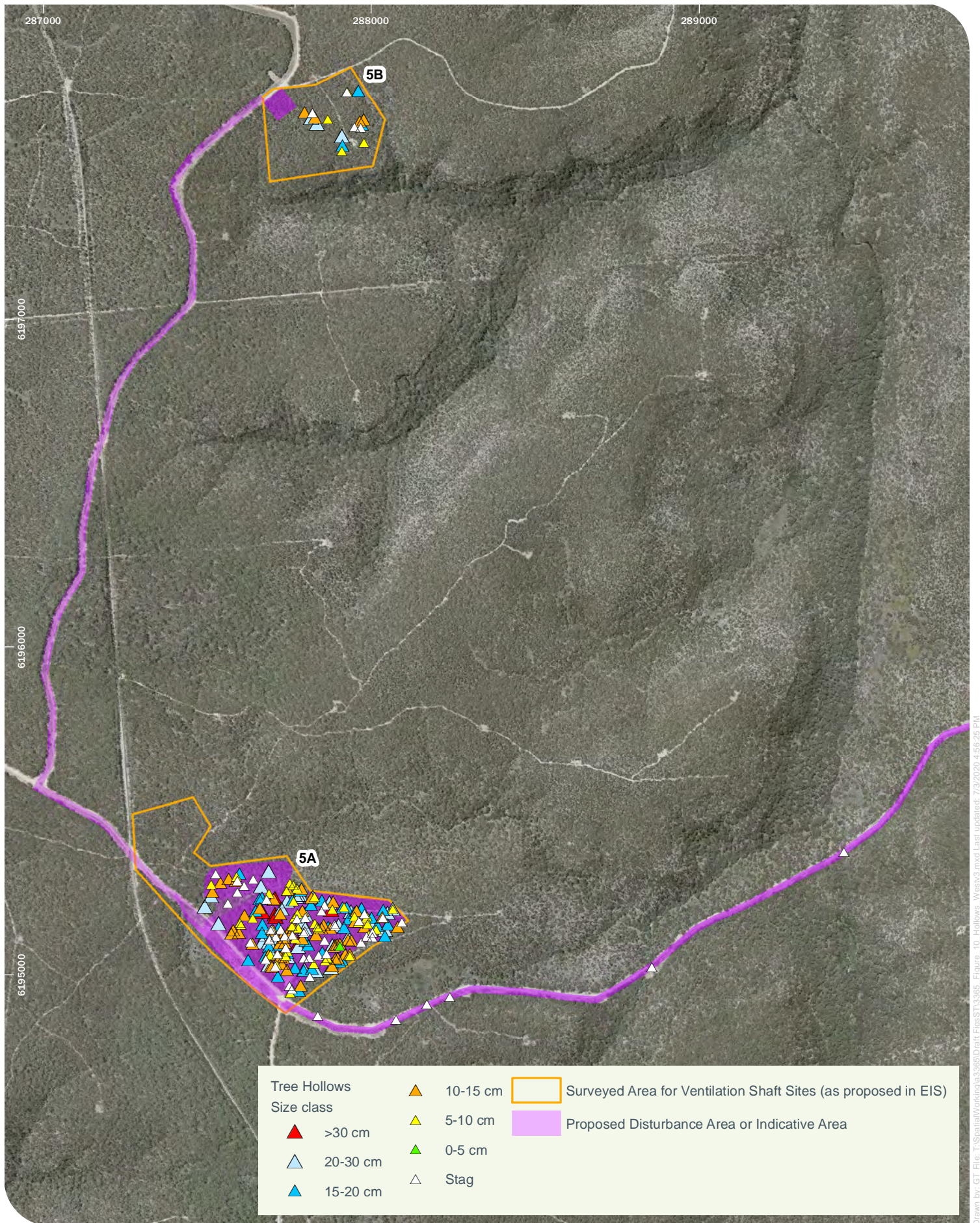
Drawn by: GT File: T:\spatial\projects\va3300\va3365_Dendrobium_BAMaps\report\Supp_2020\3365_Figure_7_Pit_top_carpark.mxd Last updated: 7/2/2020 9:44:30 AM



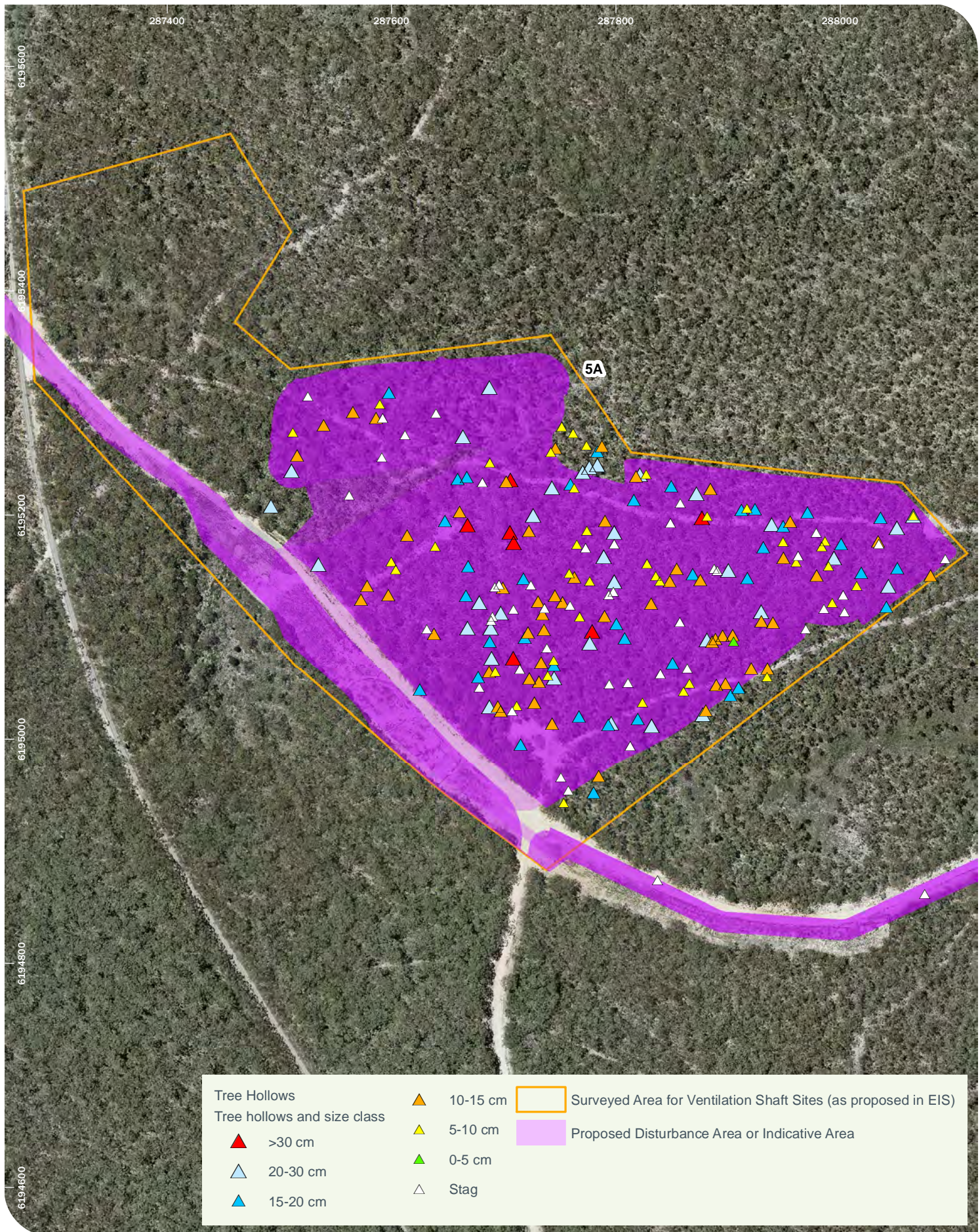
Drawn by: GT File: T:\Spatial\Working\3365\Draft Figs\ST3365_Figure_8_Results_West.v3.mxd Last updated: 7/3/2020 4:51:38 PM



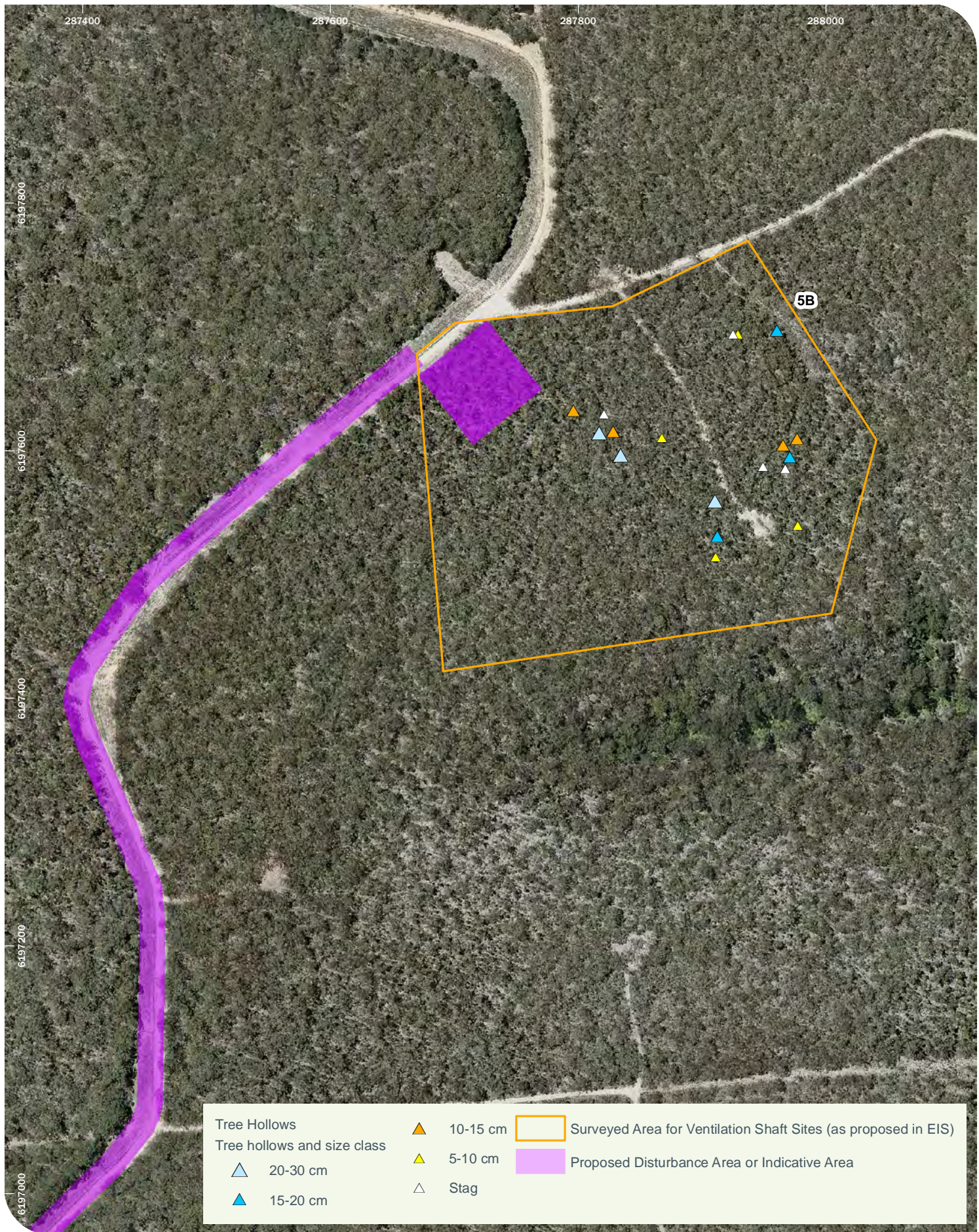
Drawn by: GT File: T:\Spatial\Working\3365\Draft Figs\ST3365_Figure_9_Results_Eastv2.mxd Last updated: 7/9/2020 12:20:53 PM



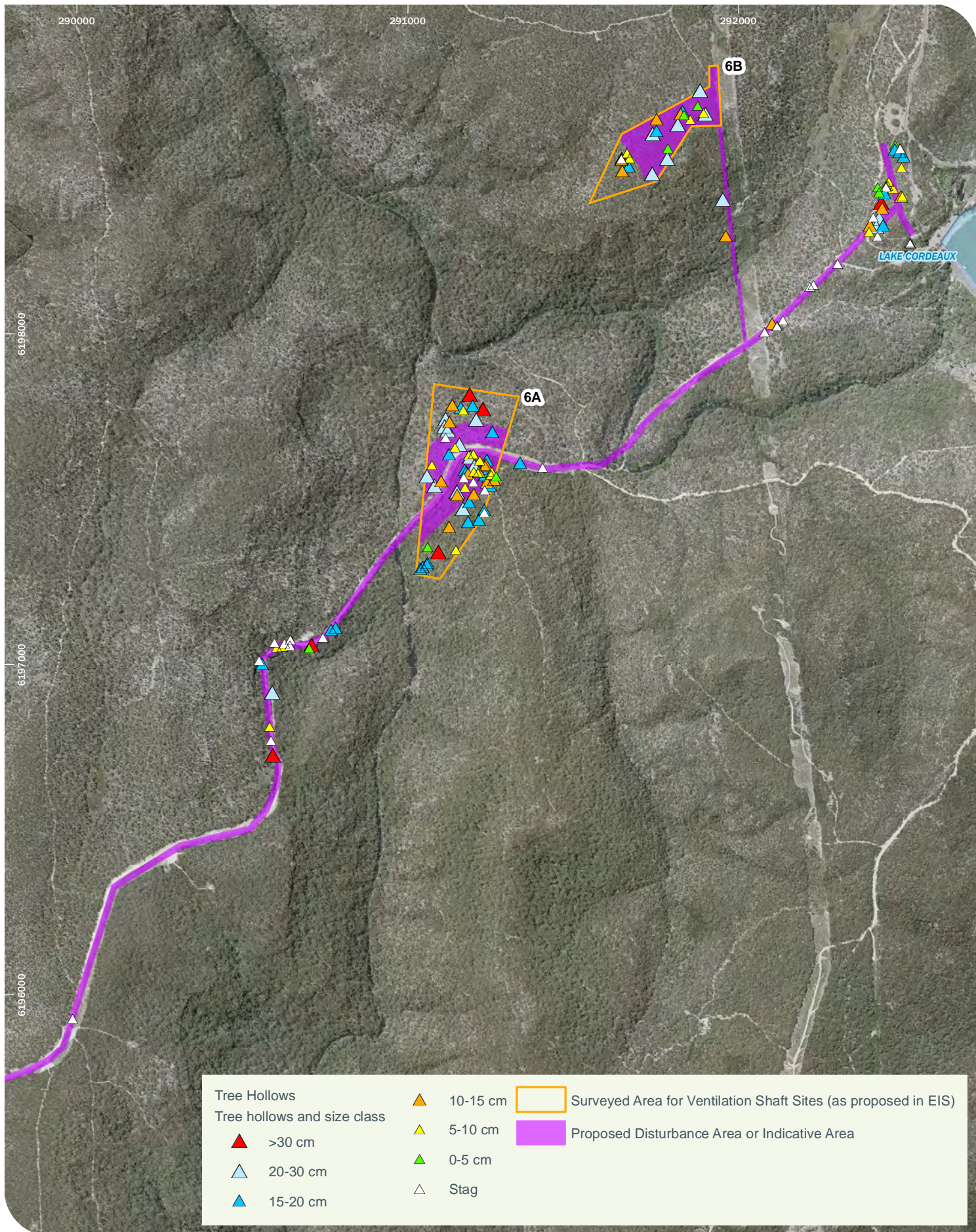
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\ST3365_Figure_10_Hollows_Web3.mxd Last updated: 7/3/2020 4:56:25 PM

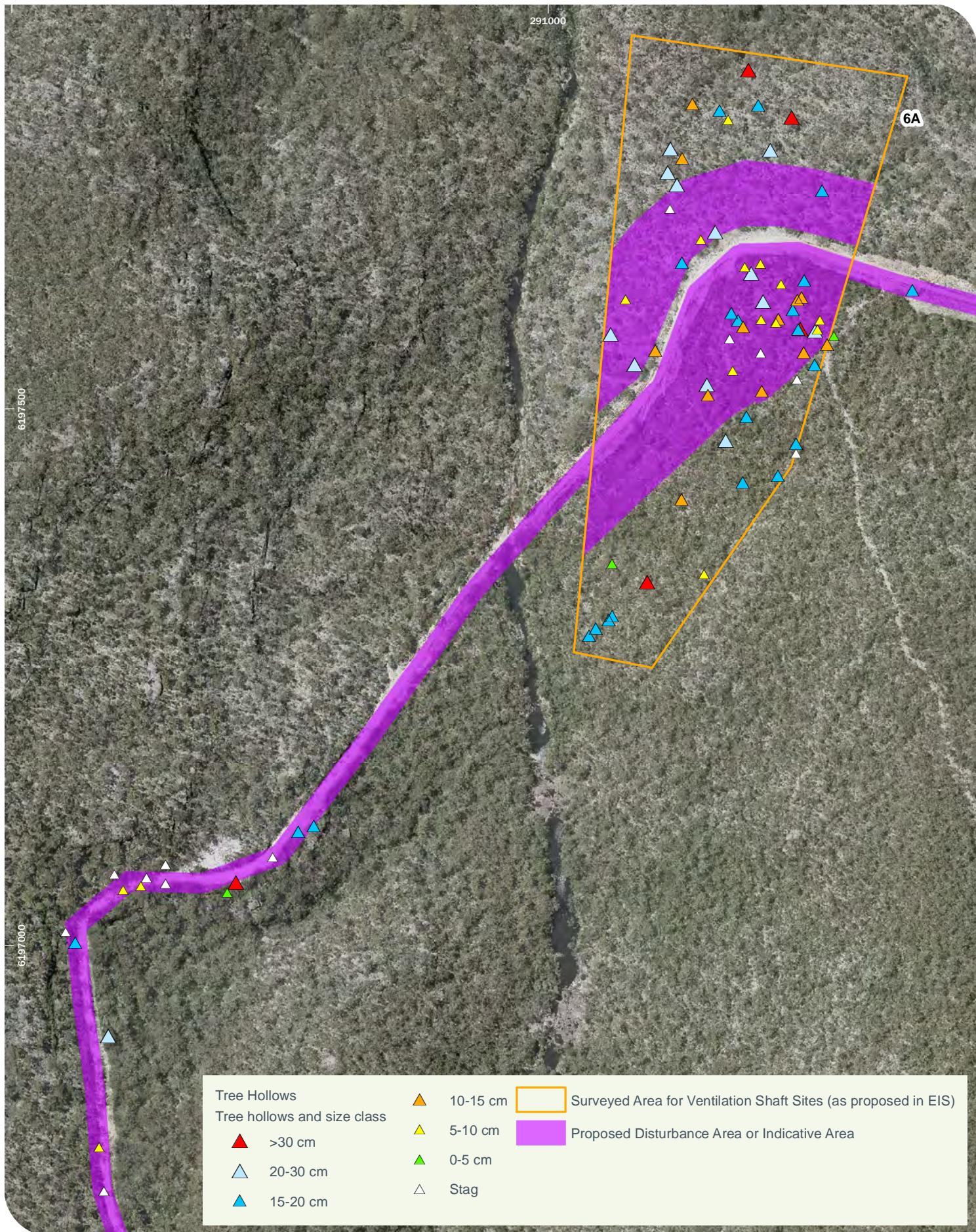


Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_10_1_Hollows_5a_v2.mxd Last updated: 7/3/2020 12:33:22 PM



Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\T3365_Figure_10_2_Hollows_5Bv2.mxd Last updated: 7/9/2020 12:37:36 PM

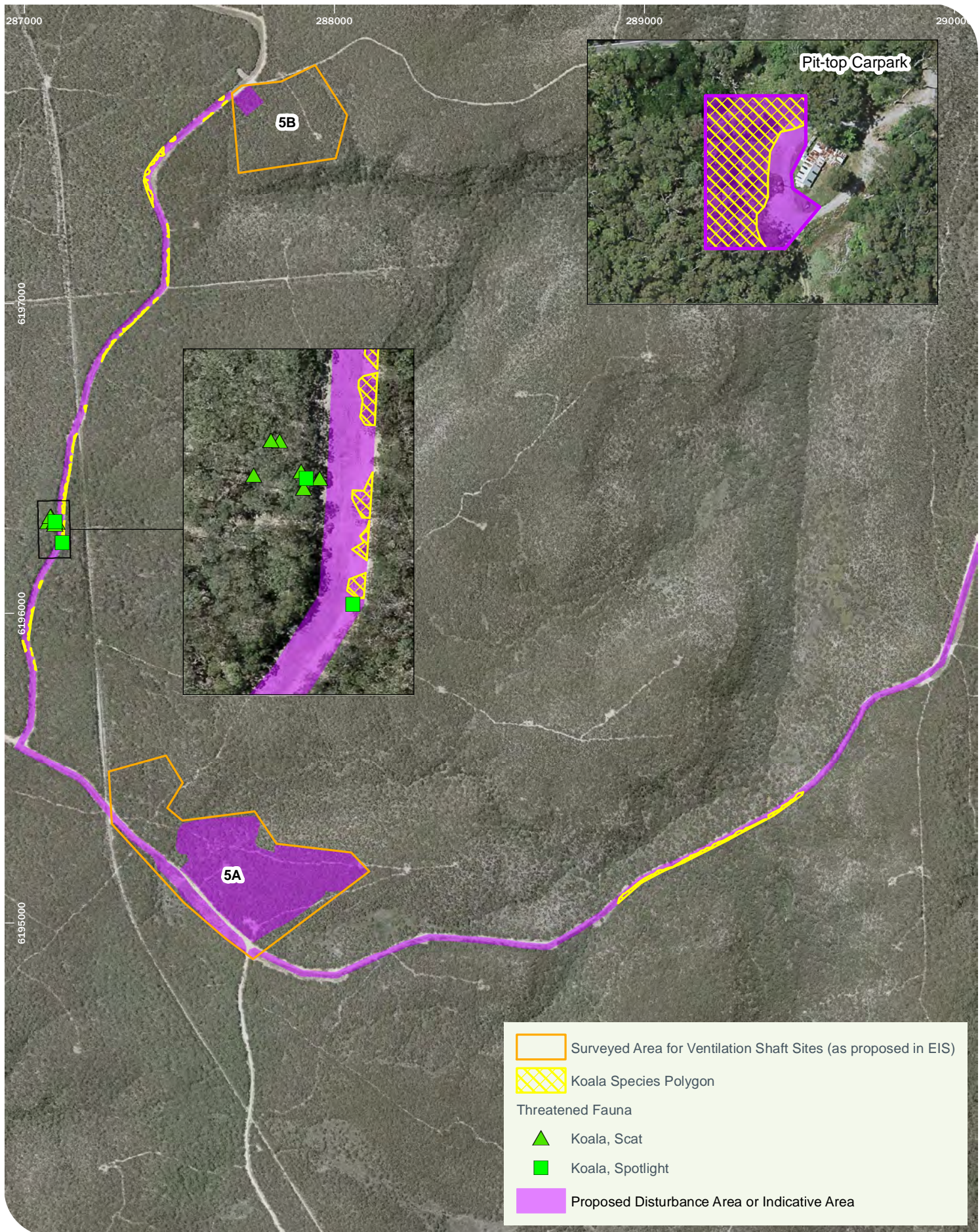




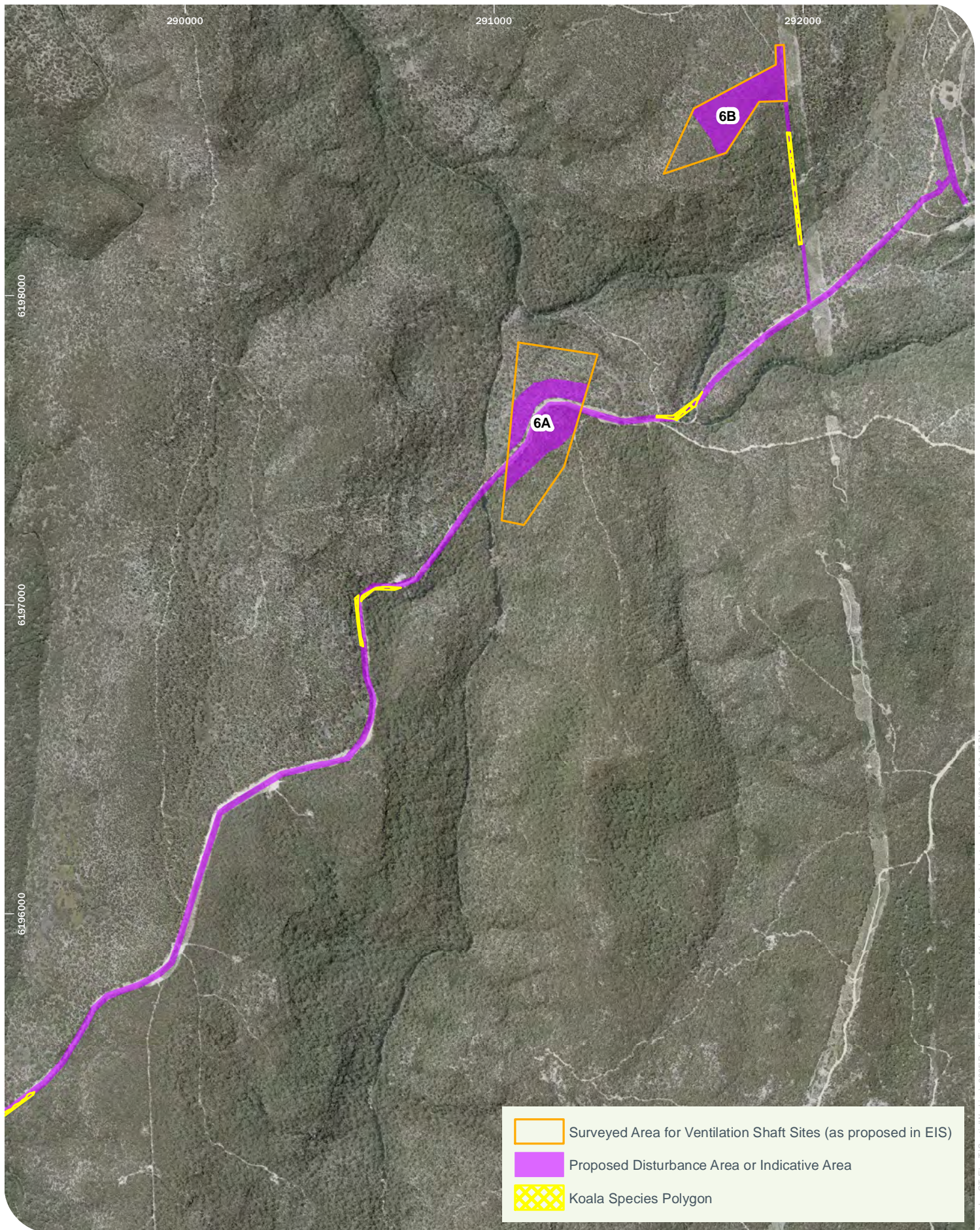
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_11_1_Hollows_6A2.mxd Last updated: 7/3/2020 12:46:17 PM



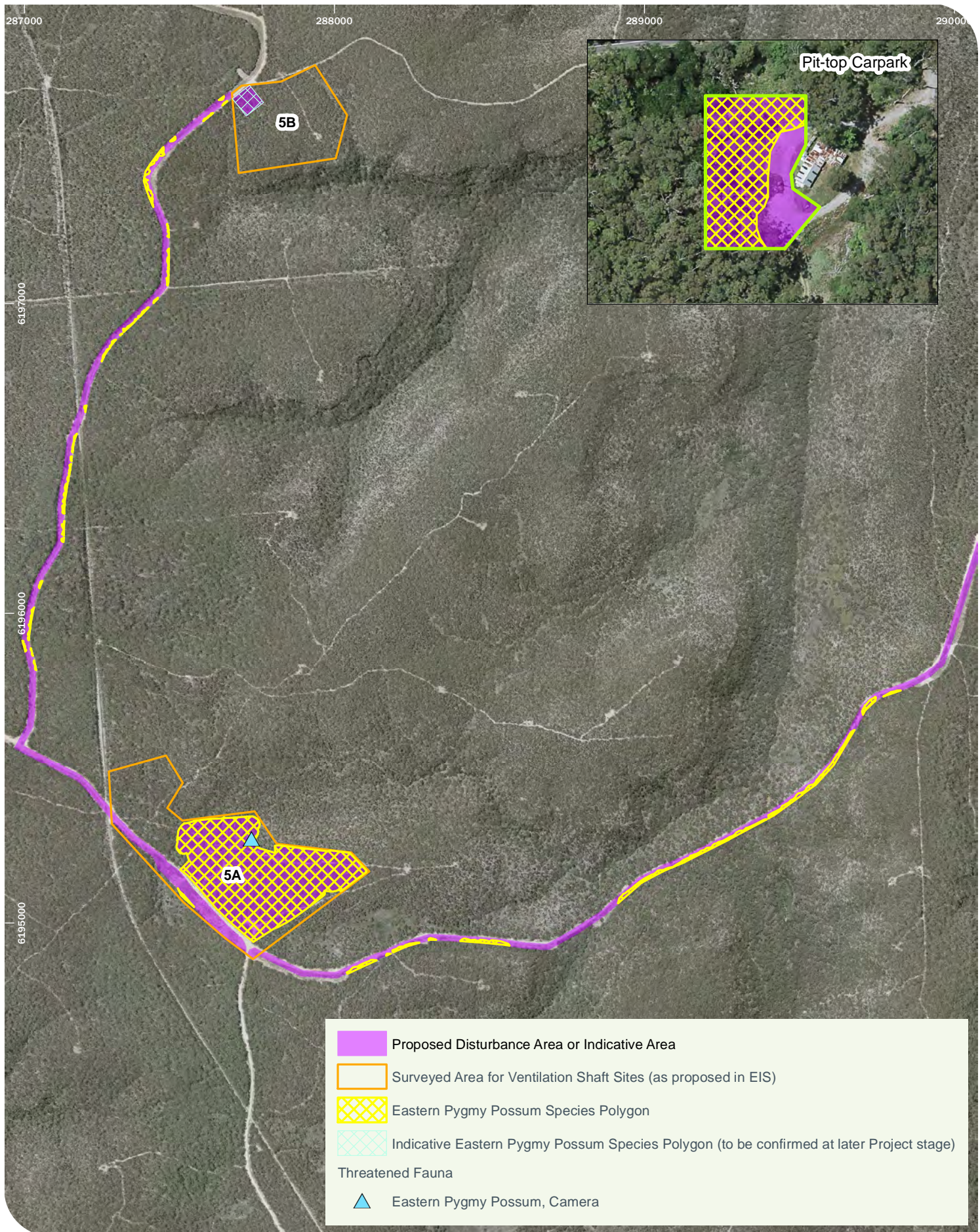
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_11_2_Hollows_6B_v2.mxd Last updated: 7/3/2020 12:52:23 PM



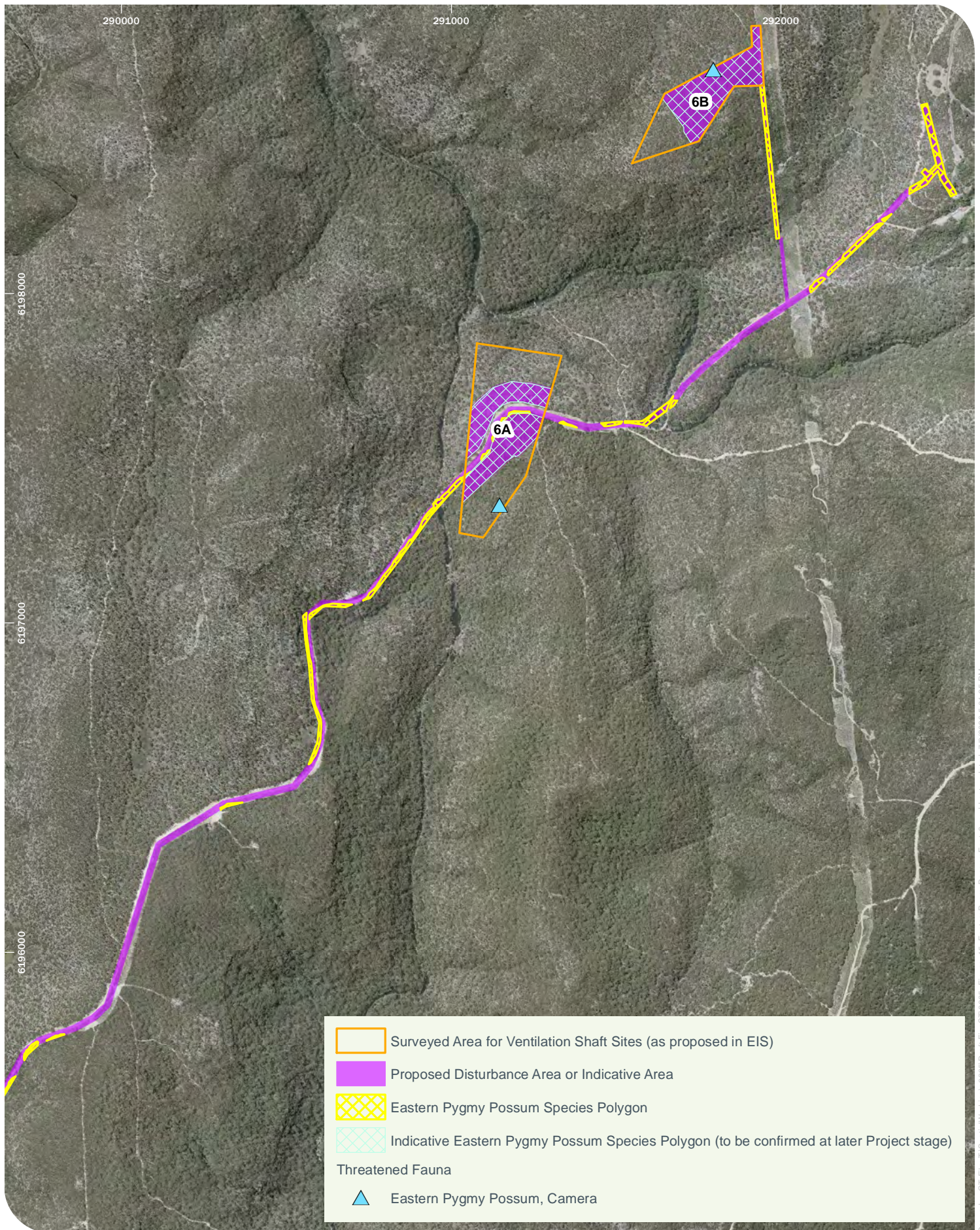
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365.mxd Last updated: 7/9/2020 4:29:08 PM



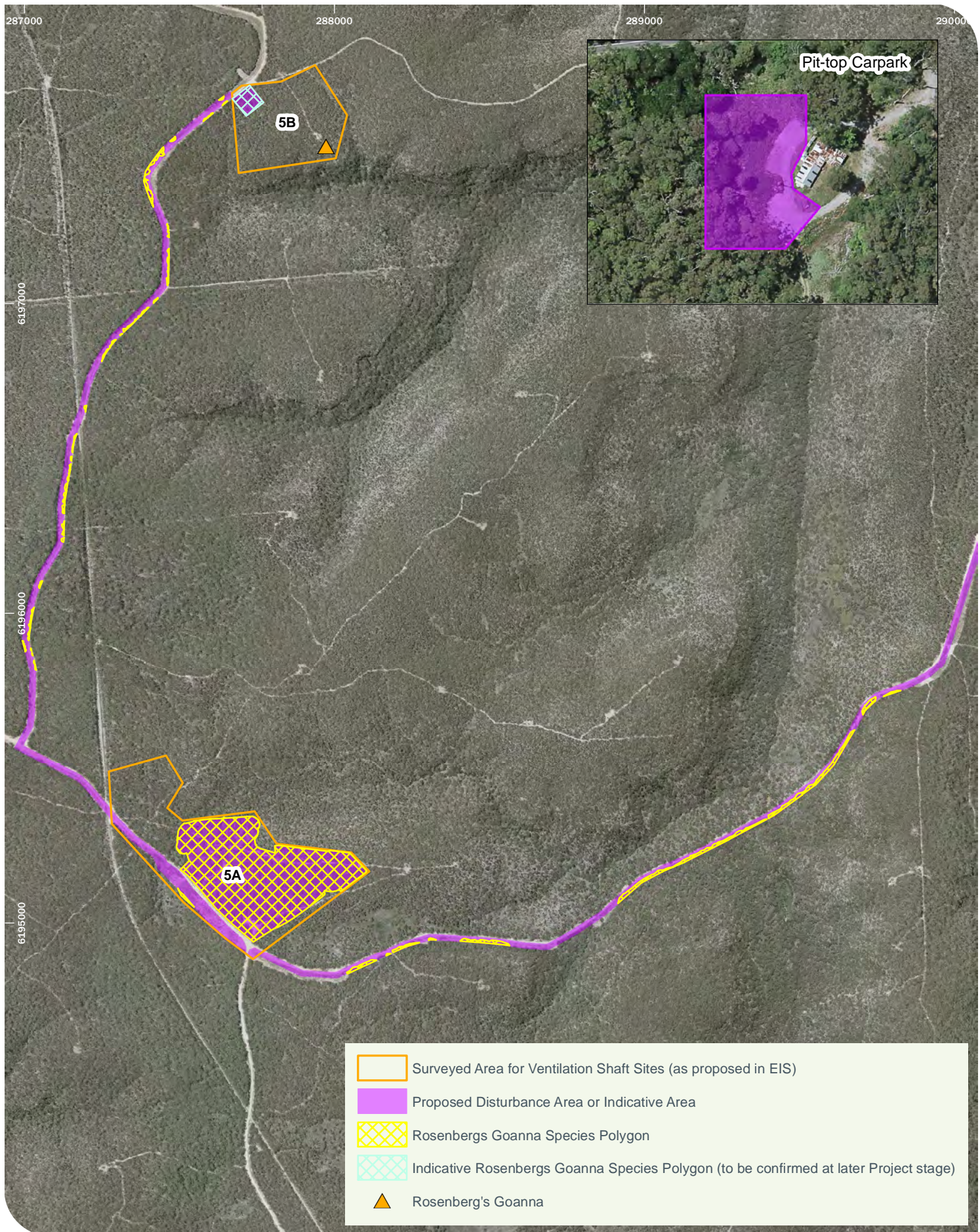
Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\3365_Figure_13_Koala_EastV2.mxd Last updated: 7/3/2020 1:09:47 PM



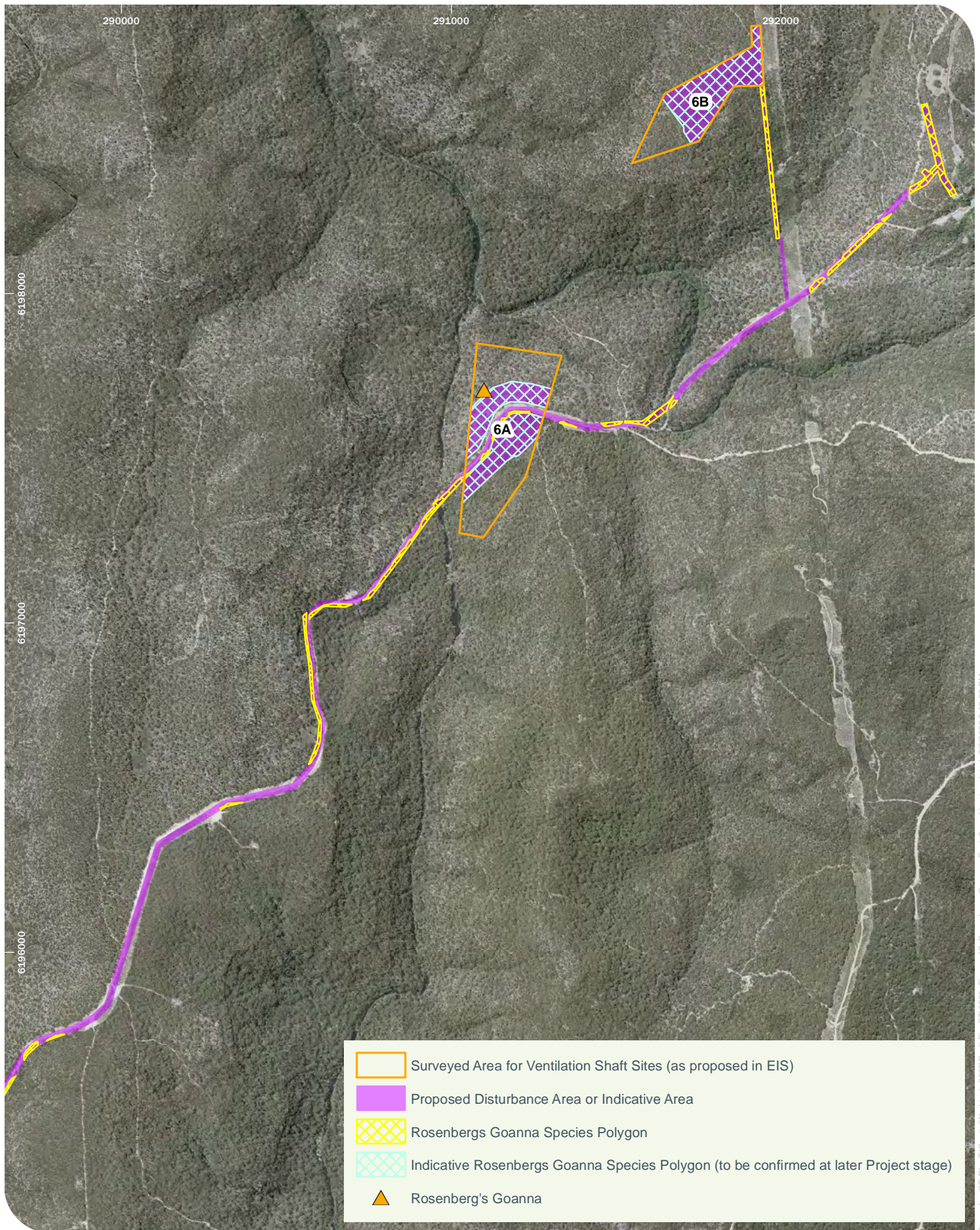
Drawn by: GT File: T:\SpatialWorking\33365\Draft Figs\ST3365_Figure_14_EasternPygmyPossum_West_v3.mxd Last updated: 7/3/2020 4:59:00 PM



Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\ST3365_Figure_15_EasternPygmyPossumEast.vxd Last updated: 7/9/2020 5:01:35 PM



Drawn by: GT File: T:\SpatialWorking\3365\Draft Figs\ST3365_Figure_16_RosenbergsGoanna_West.v3.mxd Last updated: 7/3/2020 5:09:48 PM



Annexure 1. Vegetation Plot and Transect Results

Table 10. Plots Completed within the Transmission Line Easement

Plant Community Type (PCT)	Condition	Area of impact (ha) for the transmission line easement	Area of impact for the installation of power poles	Plots required as per FBA	Plots completed (supplementary report only)
1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin Bioregion (HN566)	Good	3.00	0.00	2	3
	Regeneration	0.00	0.10	1	3
1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (HN556)	Good	0.45	0.00	1	1
	Regeneration	0.00	0.10	1	1
1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (HN651)	Good	0.85	0.00	1	4
Total					12

Table 11. BioBanking Transect Results

plot_name	nps	nos	nms	ngcg	ngcs	ngco	epc	nth	or	fl	Easting	Northing
3365sh02	27	0	0	54	42	23	0	0	1	0	290243	6196402
3365sh04	32	0	0	19	8	9	0	0	1	0	289197	6195250
3365sh01	54	25.6	16	34	46	12	0	2	1	32	290573	6196831
3365sh03	38	10.5	14.5	66	58	24	0	1	1	57	290174	6196321
3365sh06	36	8	33	6	10	6	0	1	1	10	292492	6198449
3365sh09	26	0	0	36	58	20	0	0	1	0	292019	6198069
3365SH12	39	0	3.5	58	92	30	0	0	1	0	291995	6198274
3365sh05	32	20	4.2	46	12	24	0	3	1	64	289262	6195251
3365SH10	38	9.5	0.5	26	24	8	0	1	1	5	291646	6197619
3365SH11	37	10.5	0	32	42	14	0	3	1	5	291604	6197616
3365sh07	31	0	0	69	7	22	0	0	1	0	287041	6196093
3365sh08	31	11.7	9.2	64	12	52	0	1	1	35	287074	6196088

NPS = native species richness, NOS = native overstorey cover, NMS = native midstorey cover, NGCG = native ground cover (grasses), NGCS = native ground cover (shrubs), NGCO = native ground cover (other), EPC = exotic cover, OR = overstorey regeneration, NTH = number of trees with hollows, FL = total length of fallen logs, BT = Banksia Thicket, TTT = Teatree Thicket, SC = Sedgeland Complex, CH = Cyperoid Heath, EFW = Eucalypt Fringing Woodland

Table 12. Flora Results

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Acacia binervata							0.2	1				
Acacia bynoeana		0.1										
Acacia irrorata										1	0.1	
Acacia linifolia	0.1			0.1					0.1	0.5	0.1	
Acacia longifolia	5									0.1		
Acacia longifolia subsp. longifolia				0.1	0.1	0.1						
Acacia myrtifolia	0.3										0.1	
Acacia obtusifolia										0.1		
Acacia terminalis						0.1				1		
Acacia ulicifolia		0.1		0.1							0.1	
Acianthus exsertus	0.1											
Acianthus spp.												0.1
Actinotus minor		0.1										
Allocasuarina littoralis									0.1	0.1	0.2	0.1
Allocasuarina torulosa					2							
Aristida ramosa									0.5			
Aristida vagans									0.1			
Aristida warburgii		0.2										
Astrotricha latifolia								0.1				
Banksia ericifolia	0.1											0.5
Banksia serrata	1	0.1				15						
Banksia spinulosa	5				0.1				0.3		0.1	0.2
Banksia spinulosa var. spinulosa						0.2						
Billardiera scandens	0.1				0.1		0.1			0.1	0.1	
Blechnum cartilagineum										0.2		
Bolboschoenus spp.						0.1						
Boronia parviflora									0.3	0.1		0.1
Boronia spp.												0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Bossiaea heterophylla	0.1						0.1					0.1
Bossiaea obcordata	0.3				0.1							0.1
Bossiaea prostrata		0.1										
Brunonia australis					0.1							
Brunoniella australis				0.1								
Brunoniella pumilio												
Brunoniella spp.	0.1											
Callitris rhomboidea										0.1		
Carex appressa												0.1
Carex inversa										0.2	0.1	
Cassytha glabella	0.1									2		
Caustis flexuosa	0.2	0.1										0.2
Centella asiatica								0.3				
Ceratopetalum apetalum										0.5		
Cheilanthes sieberi subsp. sieberi							0.1					
Chloanthes stoechadis	0.1											
Clematis aristata					0.1			0.1				
Conospermum ellipticum		0.1										
Conospermum longifolium		0.1										
Correa alba var. alba										0.1	0.1	
Corybas aconitiflorus	0.3											
Corybas spp.								2				
Corymbia gummifera	20	0.2			10	1						
Cryptandra spinescens										0.1		
Cryptostylis spp.						0.1						
Cyathochaeta diandra		0.5				0.1			0.2		0.1	
Cynodon dactylon var. dactylon				0.1			0.5					
Dampiera purpurea				0.1	0.1		0.1	0.1				
Dampiera stricta		0.1		0.1		0.1						
Daviesia ulicifolia					0.1							

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Daviesia ulicifolia subsp. ulicifolia				0.1								
Desmodium spp.											0.1	
Dianella caerulea							0.1	0.1			0.2	
Dianella caerulea var. caerulea	0.1											
Dianella revoluta	0.1											
Dianella revoluta var. revoluta				0.2								
Dichondra repens							0.1					
Dillwynia retorta										0.2		
Dodonaea triquetra	0.2									0.2		
Doodia aspera								5		0.3		
Echinopogon caespitosus							0.1	0.1				
Empodisma minus												0.1
Entolasia marginata							0.1	0.1	0.2			
Entolasia stricta		0.2		0.1						0.5	0.3	0.1
Entolasia whiteana	0.2			0.1	0.2	0.1						
Epacris pulchella												0.1
Epacris purpurascens var. purpurascens									0.1			
Eragrostis brownii				0.1					0.1			
Eriostemon australasius	0.1					0.3						0.1
Eucalyptus crebra								2				
Eucalyptus eugenioides	0.1				5		0.2	15				
Eucalyptus globoidea												
Eucalyptus piperita				5	30							
Eucalyptus punctata								10				
Eucalyptus punctata subsp. punctata	10						0.1					
Eucalyptus racemosa			30						0.1			
Eucalyptus sclerophylla		0.1				10						
Eucalyptus sieberi										30	45	0.2
Gahnia aspera								1				
Genoplesium spp.		0.1				0.2						0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Glycine tabacina							0.1					
Gompholobium grandiflorum	0.1											
Gonocarpus tetragynus	0.1					0.1						
Gonocarpus teucroides				0.1			0.1	0.1			0.1	
Goodenia hederacea	0.1			0.1			0.3					
Grevillea mucronulata	0.2			0.1	0.1						0.3	0.1
Grevillea oleoides									0.5	0.1		0.1
Hakea dactyloides		0.4			0.1						0.1	1
Hakea gibbosa	0.1					1						
Hakea sericea					0.3				0.1	0.2	0.1	0.5
Hardenbergia violacea	0.1				0.1						0.1	
Hibbertia aspera			0.1	0.1				5			0.1	
Hibbertia aspera subsp. aspera							0.2					
Hibbertia circumdans												0.1
Hibbertia spp.												0.4
Hovea linearis	0.1				0.1						0.1	
Hypericum gramineum							0.1					
Imperata cylindrica									0.2			
Isopogon anemonifolius	0.1				0.2	0.3			0.2			1
Kennedia rubicunda								0.1				
Kunzea ambigua							0.2		10			
Lagenifera stipitata							0.1	0.1				
Lagenophora gracilis	0.1			0.1								
Lambertia formosa	0.2	0.1				0.1						
Lasiopetalum parviflorum										0.1	0.2	0.1
Laxmannia gracilis						0.1						
Lepidosperma laterale						0.1	0.1	5	0.2			
Lepidosperma limicola											0.1	0.2
Lepidosperma spp.	0.2											
Leptocarpus tenax												0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Leptomeria acida	0.1			0.1				0.1				
Leptospermum arachnoides		0.1				0.2			1			
Leptospermum juniperinum												0.1
Leptospermum morrisonii										2		
Leptospermum polygalifolium				0.2								
Leptospermum squarrosum									0.2			
Leptospermum trinervium	1	1				10				0.2	0.2	5
Lepyrodia scariosa						0.1			2			
Leucopogon lanceolatus								0.2		0.1	0.1	
Leucopogon microphyllus						0.1			2			
Leucopogon setiger					0.1							
Leucopogon spp.									0.1			
Lindsaea linearis		0.2	0.1									
Lindsaea microphylla							0.1					
Lissanthe strigosa	0.5											
Lissanthe strigosa subsp. strigosa				0.1								
Lissanthe strigosa subsp. subulata					0.1							
Lomandra cylindrica	0.2											
Lomandra filiformis										0.1	0.1	
Lomandra filiformis subsp. coriacea					0.1	0.2						
Lomandra longifolia	0.1			0.1	0.2	0.1	0.1			0.5	0.1	0.5
Lomandra multiflora subsp. multiflora	0.2	0.1				0.1				0.1		0.1
Lomandra obliqua	0.1	0.1		0.1	0.1	0.1	0.1					0.1
Lomatia silaifolia	0.1				0.1							
Microlaena stipoides				0.1	0.1		5		0.1		0.1	
Microlaena stipoides var. stipoides	0.1							5				
Myrsine variabilis	0.1											
Notelaea longifolia								2				
Opercularia aspera										0.1		
Opercularia diphylla							0.1					

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
<i>Oxalis perennans</i>							0.1	0.1		0.1	0.1	
<i>Patersonia glabrata</i>	0.1	5		0.1	0.1							
<i>Persoonia levis</i>	0.2	0.1			0.2							
<i>Persoonia linearis</i>				0.1	0.3			3				
<i>Persoonia pinifolia</i>	0.1					0.1						
<i>Petrophile sessilis</i>		0.3			0.1	10			0.5			2
<i>Phyllanthus hirtellus</i>	0.1			0.1		0.1						
<i>Phyllota grandiflora</i>												
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	0.1											
<i>Platysace linearifolia</i>	0.1					0.1			0.1	0.2	0.1	
<i>Pomax umbellata</i>		0.1		0.1	0.1		0.1			0.1		
<i>Pratia purpurascens</i>				0.1			0.1	0.5				
<i>Pteridium esculentum</i>	0.2				15		0.5	0.1		1	0.2	1
<i>Pterostylis</i> spp.							0.2	5				
<i>Pultenaea ferruginea</i>	0.1											
<i>Rytidosperma</i> spp.				0.1				0.1				
<i>Schoenus brevifolius</i>											0.1	
<i>Smilax glyciophylla</i>						0.1						
<i>Solanum prinophyllum</i>											0.1	
<i>Stylidium graminifolium</i>						0.1						
<i>Stylidium</i> spp.												0.1
<i>Styphelia tubiflora</i>				0.1		0.3						
<i>Telopea speciosissima</i>												
<i>Tristaniopsis laurina</i>										2	0.5	
<i>Tylophora barbata</i>								0.1				
<i>Veronica plebeia</i>							0.1					
<i>Viola</i> spp.											0.1	
<i>Xanthorrhoea</i> spp.									0.1			
<i>Xanthosia pilosa</i>	0.1									0.1		0.2
<i>Xanthosia tridentata</i>	0.1					0.1				0.1		0.1

Species	3365sh01	3365sh02	3365sh03	3365sh04	3365sh05	3365sh06	3365sh07	3365sh08	3365sh09	3365sh10	3365sh11	3365sh12
Xylomelum pyriforme												
Xyris spp.				0.1								
(blank)								0.1		0.1	0.1	0.1

Annexure 2. Fauna Species List

Table 13. Fauna Species List

Common Name	Scientific Name	BC Act Status	EPBC Act Status	Site 5A	Site 5B	Site 6A	Site 6B	Transition Forest (Fire Road 6B)	Observation Type
Eastern Rosella	<i>Platycercus eximius</i>	P	-		X				Remote Camera
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	P	-		X	X			Remote Camera
Eastern Yellow Robin	<i>Eopsaltria australis</i>	P	-			X			Remote Camera
Feathertail Glider	<i>Acrobates pygmaeus</i>	P	-						Remote Camera
Greater Glider	<i>Petauroides volans</i>	P	V					X	Spotlighting
Koala	<i>Phascolarctos cinereus</i>	V	V					X	Spotlighting/SAT survey
Lesueur's Frog	<i>Litoria lesueuri</i>	P	-	X					Remote Camera
White-striped Freetail Bat	<i>Tadarida australis</i>	P	-	X					Spotlighting
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	P	-			X			Remote Camera
Eastern Pygmy Possum	<i>Cercatus nanus</i>	V	-	X		X	X		Remote Camera
Red Wattlebird	<i>Anthochaera carunculata</i>	P	-	X					Remote Camera
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	P	-		X			X	Spotlighting
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	P	-				X		Remote Camera
Stripped Marsh Frog	<i>Limnodynastes peronii</i>	P	-	X					Remote Camera
Sugar Glider	<i>Petaurus breviceps</i>	P	-				X	X	Spotlighting/Remote Camera
Swamp Wallaby	<i>Wallabia bicolor</i>	P	-	X	X	X			Remote Camera
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	P	-		X	X			Remote Camera
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>	P	-	X					Remote Camera
Brown Antechinus	<i>Antechinus stuartii</i>	P	-	X			X		Remote Camera

Annexure 3. Response Table – Relevant BCD Comments

BCD Comment No.	EES Group Comment:	Niche Response
6	<p><i>The response in the RTS does not demonstrate that the FBA has been appropriately applied in relation to the Pit Top Carpark extension and further information is still required.</i></p> <p><i>The FBA must be applied to all aspects of the proposed development as presented. The development includes an allowance for clearing 9.5 ha of vegetation in ancillary areas that have not been determined. Key aspects of the FBA, including avoidance, mitigation and offsetting cannot be addressed in the absence of necessary details.</i></p>	<p>The Project EIS included an allowance for clearance of 9.5 ha of native vegetation in the Project offset liability to account for ancillary surface infrastructure where, at that stage, the location could not be defined.</p> <p>Since lodgement of the Project EIS, South32 has undertaken further design development of this ancillary surface infrastructure, including:</p> <ul style="list-style-type: none"> • amendment of the disturbance extent of Ventilation Shaft Site No 5A to incorporate: <ul style="list-style-type: none"> – additional service boreholes which previously did not have a fixed location; and – ventilation and gas management infrastructure previously located at Ventilation Shaft Site No 5B; and • finalisation of the alignment of Electricity Transmission Lines (ETLs) that will supply the ventilation shafts. <p>The final ETL alignment was selected to avoid clearing where practical via use of existing fire access trails and road reserves. There is no change with regard to South32's commitment to avoid direct impacts to Upland Swamp vegetation from Project surface disturbance works.</p> <p>Additional survey work has recently been completed for surface infrastructure where the location was not fixed and a disturbance allowance was proposed, in response to BCD comments and to address refinements to the design of the surface infrastructure. Sections 2 and 3 of this report details methods of additional survey completed within surface infrastructure areas.</p> <p>The outcomes of the surveys for targeted threatened fauna species are shown in (Figure 7 to Figure 9). New or updated species polygons for threatened fauna are described in detail below and associated species credit requirements are provided in Section 4 (Tables 8 and 9). Updated survey and species polygons include surveys within the Pit-top Carpark and assumptions of presence within that area for any relevant species credit species associated with the vegetation or habitats to be removed.</p>
7	<p><i>To date no map of hollow bearing trees has been supplied. A map of hollow bearing trees is required to ensure the key FBA component of avoiding biodiversity values is met, in addition to determining whether certain species credit species occur (eg powerful owl).</i></p>	<p>Hollow bearing trees have been mapped within areas of proposed clearing (Figure 10 and Figure 11). The capacity to avoid hollow bearing trees was limited due to their high densities within proposed ventilation shaft sites and wider catchment generally. The location of ventilation shaft sites were biased towards ridgetops, away from watercourses and other more ecologically constrained ecosystem types such as Shale Sandstone Transition Forest TEC.</p> <p>There is a high abundance of hollows throughout the catchment area particularly in scribbly gum (<i>E. racemosa</i>) trees prevalent within the ventilation shaft sites. It was demonstrated that while hollows are abundant, hollow use is limited with a paucity of fauna recorded from ventilation shaft sites during repeated survey over months and years. This contrasts to fauna abundance in higher fertility areas of the study area including Shale Sandstone Transition Forest TEC, clearance of which is largely avoided by the Project.</p>
8	<p><i>SEPP 44 has been revised to reflect improved understanding of regional koala habitat use trees in the new Koala Protection SEPP. Scribbly Gum (<i>E. sclerophylla</i>) is recognized as a key koala habitat use tree in this region (OEH 2018 – A review of koala tree use across NSW – link here) and PCTs with this as a dominant species, including PCT 1083, must be included in calculations for koala habitat. Koala was recorded during surveys for the EIS and is known to be present.</i></p> <p><i>The proponent has not confirmed that the Koala is not present or unlikely to be present at the development site, as required by s6.5.1.11 of the FBA. We therefore maintain that all Koala habitat must be offset.</i></p>	<p><u>Relevant State Environmental Planning Policy</u></p> <p>The Project BARBOS considered core and potential Koala habitat within the Project area consistent with the definitions and tree species listed in <i>State Environmental Planning Policy 44 – Koala Habitat Protection</i> (SEPP 44). Since lodgement of the Project EIS, SEPP 44 has been repealed and replaced with the <i>State Environmental Planning Policy (Koala Habitat Protection) 2019</i> (The Koala Habitat Protection SEPP) which commenced on 1 March 2020.</p> <p>The transitional provisions of the Koala Habitat Protection SEPP states (Part 4, Clause 15):</p> <p><i>A development application made, but not finally determined, before the commencement of this Policy in relation to land to which this Policy applies must be determined as if this Policy had not commenced.</i></p> <p>Consideration of Koala habitat consistent with the definitions of the Koala Habitat Protection SEPP is not required for the Project.</p>

BCD Comment No.	EES Group Comment:	Niche Response
		<p>A Koala Plan of Management (Niche, 2019a) (KPoM) has also been prepared for the Project (Appendix 11 of the Appendix D of the EIS) in accordance with the requirements of SEPP 44. The KPoM outlines management strategies to be implemented to minimise impacts to the Koala for the Project.</p> <p><u>Koala Survey Extent</u></p> <p>Threatened fauna surveys undertaken for the BARBOS did not definitively identify Koalas within the ventilation shaft sites. Surveys around the ventilations shaft sites where PCT 1083 is present recorded a single calling Koala, however its exact location could not be determined given the call was heard distantly at the time of survey. It was reasoned within the BARBOS that if the Koala was present from the vent shaft site it was likely moving through the area rather than resident. It was also noted that area where the Koala was heard is relatively close to known areas of Koala occupation in nearby Sandstone Transition Forest. Koalas were assumed to be present in the allowance of disturbance of 1.5 ha of Shale Sandstone Transition Forest TEC associated with infrastructure that did not have a fixed location at the time of EIS lodgement.</p> <p>As a component of additional fauna surveys undertaken for surface disturbance areas (Sections 2 and 3), further survey for the Koala was undertaken within the ventilation shaft sites and along the confirmed ETL alignment. Survey was undertaken in accordance with the methods described in Appendix C of the draft Koala Habitat Protection Guideline (DPIE, 2020) and included the following:</p> <ul style="list-style-type: none"> SAT plots at each of the ventilation shaft sites, Sandstone Ridgetop Woodland areas of the ETL (PCT 1083) as well as a reference site within Shale Sandstone Transition Forest TEC along the ETL alignment. Songmeter recording within the ventilation shaft sites. Spotlighting within the ventilation shaft sites and along portions of the ETL alignment. Nocturnal call playback within and adjacent to ventilation shaft sites and areas of potential Koala habitat. <p>Note, where feed tree species listed under the Koala Recovery Plan (DECC 2008) or SEPP 44 were not present within the ventilation shaft sites, feed tree species listed under the updated Koala Habitat Protection Guideline (DPIE 2020) (which accompanies the Koala Habitat Protection SEPP) were used as focus trees. BCD has previously requested HN566 be included in the Koala species polygon due to the presence of feed tree species listed under the Koala Habitat Protection Guideline. No Koalas were recorded during surveys of these trees.</p> <p>Koalas were recorded at the Shale Sandstone Transition Forest TEC reference site along the ETL alignment during spotlighting, call playback and SAT plot recording. No Koala presence was recorded at any of the ventilation shaft sites, consistent with the results of the surveys undertaken for the BARBOS.</p> <p>The survey effort and results confirm that the Koala is not present or unlikely to be present in HN566 other than to move through the area, as required by s6.5.1.11 of the FBA.</p> <p><u>Refined Koala Species Polygon</u></p> <p>The Project EIS assumed presence of Koalas in the allowance of disturbance of 1.5 ha of Shale Sandstone Transition Forest TEC associated with infrastructure that did not have a fixed location at the time. The species credit requirement associated with this assumed presence totalled to 39 credits.</p> <p>The additional design development and surveys since lodgement of the Project EIS has refined the extent of Shale Sandstone Transition Forest TEC and additional confirmed potential habitat. The refined Koala species polygon (Figure 12 and Figure 13) also totals to 1.5 ha, consistent with the Project EIS allowance, and comprises:</p> <ul style="list-style-type: none"> 0.45 ha of HN556 (Shale Sandstone Transition Forest TEC) within the ETL alignment. 0.85 ha of HN651 (Peppermint Gully Forest) within the ETL alignment (assumed presence based on preferred tree species and recorded with cameras from this vegetation type within the BARBOS). 0.2 ha of HN597 within the Pit Top Carpark Extension area (assumed presence). <p>Therefore, the Koala species credit requirement has not changed from the Project EIS (refer Section 4, Table 9). Koala species credits are not required due to disturbance of the ventilation shaft sites.</p>

BCD Comment No.	EES Group Comment:	Niche Response
9	<p><i>Inadequate assessments have been undertaken given the magnitude of potential loss of threatened aquatic and swamp species. No electrofishing was conducted in areas of the streams above the proposed longwalls for Dendrobium Area 5 & 6.</i></p> <p><i>We do not agree with the proponent's rationale to treat all surface development areas as a single stratification unit, thus eliminating the need to carry out targeted surveys at individual development sites. Stratification should not be based purely on PCT type. Other factors including landscape position, disturbance and fire history, distance to water etc. must be considered when determining survey effort. There is considerable distance between each ventilation shaft (up to 5km), and all sites are easily accessible and of a size able to be surveyed.</i></p> <p><i>The FBA requires a proponent to determine if a candidate species is present on a development site or is likely to use the potential habitat on that site. If adequate surveys are not carried out to determine whether a candidate species is present or likely to use potential habitat on that site, the species should either: 1) be assumed present, or 2) an expert report prepared to confirm that it does not occur.</i></p> <p><i>The BAR needs to provide clarity that all candidate species credit species were adequately surveyed at each ventilation shaft (and other surface areas to be cleared).</i></p> <p><i>Specific advice for relevant species is provided below:</i></p> <ul style="list-style-type: none"> <i>Powerful owl: The proponent has not provided detail on hollow bearing trees so it is difficult to conclude the site does not contain breeding or roosting habitat for this species. We do not accept the conclusion that landscape positioning was not appropriate for breeding and roosting habitat for this species. Niche (2019a) states powerful owls roost and nest "in sheltered gullies....within 100m of streams or minor drainage lines...". All ventilation shafts contain either sheltered gullies or watercourses.</i> <i>Rosenberg's goanna: This species is listed as a species credit species under the FBA. A species polygon is required. The proponent should determine if biobanking credits are available for this species and describe evidence of efforts to source these credits. If credits are unavailable this species may be offset via ecosystem credits.</i> <i>Eastern pygmy possum: The RTS relies on the rationale that adequate survey was done based on combined survey effort across the project area. We do not consider this is adequate to confirm the species does not occur at sites where targeted survey was not done.</i> <i>Survey effort, as shown in Figure 10 and detailed in Section 6.3 of the EA, still requires clarification. Further targeted surveys may be required for surface areas that were not adequately surveyed.</i> 	<p>Additional survey for the Project was undertaken between 28 April 2020 and 22 May 2020 across 11 days and nights and focused on the ventilation shaft sites and confirmed ETL alignment. Additional Koala SAT plots (5) were conducted on the 29th of June and the 1st of July. Surveys included vegetation validation and threatened flora and fauna and were undertaken in accordance with the NSW Offset Policy and OEH survey guidelines and databases.</p> <p>Two additional threatened flora species were identified along the ETL alignment during vegetation validation surveys:</p> <ul style="list-style-type: none"> <i>Acacia bynoeana</i> – within slashed vegetation within the existing fire trail easement. <i>Epacris purpurascens</i> – adjacent to the ETL alignment. <p>Disturbance associated with the ETL alignment (i.e. construction of poles) would be managed in accordance with a vegetation clearance protocol to avoid direct impact of any threatened flora species and on this basis this species is not relevant to the Project offset liability.</p> <p>In consideration of BCD's comments, the following threatened fauna species were targeted during the surveys:</p> <ul style="list-style-type: none"> Eastern Pygmy Possum (<i>Cercartetus nanus</i>). Powerful Owl (<i>Ninox strenua</i>). Koala (<i>Phascolarctos cinereus</i>). <p>Survey methods were selected to detect the target species listed above, however are also relevant to other potentially occurring threatened fauna within the Project disturbance area.</p> <p>The survey effort within each disturbance area is shown on Figure 5 to Figure 7 and described in Section 2 and 3. The survey methodology and species polygon specific to the Koala is described in detail in the response to Comment 8 above.</p> <p>The outcomes of the surveys for other targeted threatened fauna species are also shown in Figure 5 to Figure 7. New or updated species polygons for threatened fauna are described in detail below and associated species credit requirements are provided in Section 4 (Tables 8 and 9).</p> <p><u>Powerful Owl</u></p> <p>Vegetation surveys undertaken for the Project EIS identified trees with hollows within the ventilation shaft areas, however Niche (2019) concluded it is highly unlikely the Powerful Owl would roost in the identified hollows due to the landscape positioning of the surface disturbance areas on ridgetops as well as vegetation present and prey availability. As such, breeding habitat was not considered to be present in Project surface disturbance areas and Powerful Owl species credits were not considered required for offsetting.</p> <p>In response to BCD's comments regarding the Powerful Owl, detailed mapping and assessment of hollow bearing trees has been undertaken (Figure 10 and Figure 11) within the Project surface disturbance areas. Further targeted survey for the Powerful Owl was also undertaken within Project surface disturbance areas, including assessment of tree hollow size, incidental owl pellet survey during SAT plots, dusk watches, acoustic recording and spotlighting.</p> <p>Powerful Owl was not recorded during the targeted surveys. Trees containing hollows of sufficient size for breeding were identified in the surface disturbance areas, however they are located within HN566 vegetation which is not listed as Powerful Owl breeding habitat under the OEH databases used by the BioBanking Credit Calculator (TSPD). Therefore, Powerful Owl species credits are not required for any proposed surface disturbance.</p> <p>The offset liability described in the Project EIS included an allowance for clearance of 1.5 ha of Shale Sandstone Transition Forest TEC (HN651) to account for ancillary surface infrastructure where, at that stage, the location could not be defined. Powerful Owl habitat has been assumed present in the Shale Sandstone Transition Forest TEC, however no potential breeding hollows would be cleared from this area and therefore the species would be offset via ecosystem credits.</p> <p><u>Eastern Pygmy-possum</u></p> <p>The Eastern Pygmy-possum was not detected during targeted surveys of the ventilation shaft sites undertaken for the Project EIS and the presence of the species was not considered likely within the Pit-top Carpark Extension area due to degraded habitat.</p> <p>However, in consideration of comments received from the BCD, additional targeted survey has been undertaken of the ventilation</p>

BCD Comment No.	EES Group Comment:	Niche Response
		<p>shaft areas. During these surveys the Eastern Pygmy-possum was detected at three of the four ventilation shaft sites (Figure 8 and Figure 9).</p> <p>On the basis of confirmed records of the Eastern Pygmy-possum in the Project areas, the species' presence was assumed at the Pit-top Carpark Extension area as the mapped vegetation (HN597) is listed as Eastern Pygmy-possum habitat within the OEH databases used by the BioBanking Credit Calculator and targeted surveys were not undertaken. The species' presence was also assumed in mapped areas of HN651 and HN556 vegetation (excluding regeneration) within the ETL alignment due to the general absence of flowering shrubs and lack of vegetation cover.</p> <p>The species polygon for the Eastern Pygmy-possum totals 27.25 ha (Figure 14 and Figure 15) which incorporates:</p> <ul style="list-style-type: none"> the ventilation shaft areas (i.e. 25.75 ha of HN566, excluding regenerating vegetation); vegetation within the ETL alignment which contains flowering shrubs (i.e. 0.85 ha of HN651 and 0.45 ha of HN556, excluding regenerating vegetation); and the Pit-top Carpark Extension area (i.e. 0.2 ha of HN597). <p>The species credit requirement for the Eastern Pygmy-possum is provided in Table 9. Potential impacts to regenerating Eastern Pygmy-possum habitat have been offset using ecosystem credits.</p> <p><u>Rosenberg's Goanna</u></p> <p>OEH databases used by the BioBanking Credit Calculator (i.e. Archived BioMetric and Threatened Species Profiles Datasets, current at the time that the calculator was submitted for the EIS) list the Rosenberg's Goanna as a species credit species.</p> <p>However, the FBA and BioBanking Credit Calculator have been superseded by the <i>NSW Biodiversity Assessment Method</i> (OEH, 2017) (BAM). Under the BAM, the credit status for the Rosenberg's Goanna has been revised to an ecosystem credit species. Therefore, it is understood that species credits for the Rosenberg's Goanna would not be able to be generated using the BAM within potential offset areas in order to satisfy any species credit offset requirement for the Project.</p> <p>On that basis a species polygon and credit requirement for the Rosenberg's Goanna was not incorporated in the Project offset liability presented in the EIS.</p> <p>BCD's comments requested a species polygon be prepared for the Rosenberg's Goanna to determine an associated Biobanking credit requirement. Note additional survey for the species was not undertaken as it has been previously identified during surveys across the Project area and was also recorded during surveys undertaken for the BARBOS within the Project area, including records within Ventilation Shaft Site Nos 5B and 6A.</p> <p>The species polygon determined for the Rosenberg's Goanna totals 27.05 ha (Figure 16 and Figure 17) which incorporates:</p> <ul style="list-style-type: none"> the ventilation shaft areas (i.e. 25.75 ha of HN566, excluding regenerating vegetation); and vegetation within the ETL alignment which contains flowering shrubs (i.e. 0.85 ha of HN651 and 0.45 ha of HN556, excluding regenerating vegetation). <p>The species credit requirement for the Rosenberg's Goanna is provided in Table 9. South32 will continue to consult with DPIE-BCD regarding consideration of the 'reasonable equivalence' of species credits for the Rosenberg's Goanna. Potential impacts to relevant Rosenberg's Goanna habitat as a result of surface disturbance would likely be satisfied by ecosystem credits given the species re-assignment to an ecosystem credit species under the BAM.</p> <p><u>Giant Dragonfly</u></p> <p>A species polygon was previously prepared for the Giant Dragonfly based on assumed presence within any swamps with breeding or potential foraging habitat (as determined within specialist reporting by Cardno 2019) and within 60 m of proposed longwall areas. No amendments to the species polygon are proposed.</p>

BCD Comment No.	EES Group Comment:	Niche Response
10	<i>To date, no credit calculator updates or shapefiles have been provided.</i>	<p>Updated ecosystem and species credit requirements for the Project are provided in Section 4 (Tables 8 and 9), incorporating refined disturbance extents for surface infrastructure as well as results of additional biodiversity surveys.</p> <p>Two additional species credit species have been incorporated in the Project offset liability, namely the Eastern Pygmy-possum and Rosenberg's Goanna. There is no change proposed for the offset liability associated with Upland Swamp vegetation, vegetation within the Pit Top Carpark Extension area or species credit species that were assessed in the BARBOS (i.e. Giant Burrowing Frog, Littlejohn's Tree Frog, Giant Dragonfly, Red-crowned Toadlet, Broad-headed Snake or Koala).</p> <p>Updated credit reports and shapefiles of species polygons and vegetation mapping within disturbance extents will be provided to BCD.</p>

Contact Us

Niche Environment and Heritage
02 9630 5658
info@niche-eh.com

NSW Head Office – Sydney
PO Box 2443 North Parramatta
NSW 1750 Australia

QLD Head Office – Brisbane
PO Box 540 Sandgate
QLD 4017 Australia

Sydney
Brisbane
Cairns
Port Macquarie
Illawarra
Coffs Harbour
Central Coast
Gold Coast
Canberra



Our services

Ecology and biodiversity

Terrestrial
Freshwater
Marine and coastal
Research and monitoring
Wildlife Schools and training

Heritage management

Aboriginal heritage
Historical heritage
Conservation management
Community consultation
Archaeological, built and landscape values

Environmental management and approvals

Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting

Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)