

DENDROBIUM AREA 3C LONGWALL 20-21 SUBSIDENCE MANAGEMENT PLAN Reasons for Approval

1. DEVELOPMENT CONSENT

- The Dendrobium Coal Mine was approved by the then Minister for Planning in 2001 following a Commission of Inquiry and was subsequently modified by a later Minister for Planning in December 2008. The 2008 modification significantly reduced the potential water impacts of the approved mine by removing longwall mining from under large sections of Wongawilli Creek and Sandy Creek.
- The existing development consent expressly allows longwall coal mining in mining Areas 1, 2, 3A, 3B and 3C. Longwall mining has already occurred in Areas 1, 2, 3A and parts of Area 3B (see **Figure 1**).

2. SMP APPLICATION

- While coal mining in Area 3C (including the area covered by Longwalls 20 and 21) is already approved, the development consent requires a Subsidence Management Plan (SMP) to be submitted and approved before any longwall mining can actually occur.
- SMPs may cover a single longwall or a group of longwalls, or in this case two longwalls (ie Longwalls 20 and 21). Each SMP is prepared in consultation with relevant NSW Government agencies.
- SMPs, including performance measures and monitoring requirements, provide a framework to avoid, minimise and mitigate subsidence impacts and maintain a robust adaptive management framework.
- The preparation of a SMP allows the assessment of impacts on all built and natural features to be focused at the local level, ensuring that impacts are appropriately monitored, and impact management regimes are further refined during the life of the project in response to subsidence monitoring and recorded impacts.
- The Department's Planning & Assessment Group (PAG) received an application for approval of a draft Longwall 20-21 SMP from South32 Illawarra Coal (South32) on 4 June 2019.
- The draft SMP comprises a number of documents. In addition to the SMP itself, conditions of consent require that the SMP integrates two other, more detailed plans, being the Watercourse Impact Monitoring, Management and Contingency Plan (WIMMCP) and the Swamp Impact Monitoring, Management and Contingency Plan (SIMMCP). Each of these two plans also contains a Trigger, Action, Response Plan (TARP). Most of the detailed monitoring, management, remediation and contingency measures applicable under the SMP are contained within the WIMMCP and SIMMCP and their associated TARPs.
- The SMP application was also supported by 7 specialist assessments addressing subsidence effects, impacts and consequences.

3. KEY MINING PARAMETERS

- The draft SMP shows that Longwall 20 is proposed to be oriented generally north-south, and to be located to the west of Wongawilli Creek. Longwall 21 is proposed to be oriented in a generally east-west direction and to the east of Wongawilli Creek (see **Figure 2**).
- The proposed total void length for Longwall 20 is 1154 metres (m) and for Longwall 21 it is 872 m. For both longwalls, the proposed total void width is 256 m (ie including first workings) and the maximum mining height would not exceed 3.9 m. The depths of cover to the Wongawilli Seam vary from 320 m to 410 m directly above Longwall 20 and from 290 m to 390 m directly above Longwall 21.
- The panel is expected to take a little over four months to extract, once longwalling begins.

4. CONSIDERATION BY AGENCIES

- PAG sought review of the SMP application and advice from WaterNSW, the Office of Environment & Heritage (OEH, now the Department's Biodiversity & Conservation Division (BCD)), the Department's Division of Resources and Geosciences (DRG), the Department of Industry (including the Natural Resource Access Regulator), the Agriculture Division of the Department of Primary Industries (DPI), the Dams Safety Committee (DSC), Subsidence Advisory NSW and the Resources Regulator.

- Detailed advice was received from WaterNSW, OEH and the Resources Regulator and short responses indicating limited or no interest from the other five agencies. These were forwarded to South32 for review and response.
- South32 provided a response to all issues raised by agencies on 17 September 2019, which was forwarded by PAG to agencies for further comment.
- Residual comments were received from BCD (15 October 2019) and WaterNSW (6 November 2019). South32 provided further advice addressing BCD's comments on 7 November.
- PAG has also held meetings and other discussions with both South32 and WaterNSW.

5. INDEPENDENT EXPERT PANEL ON MINING IN THE CATCHMENT

- In early 2018, the NSW Government established an Independent Expert Panel on Mining in the Catchment (the Panel) to review the impacts and regulation of underground coal mining in Sydney's Drinking Water Catchment. The Panel's terms of reference were to:
 - undertake an initial review of current mining in the catchment;
 - review and update the findings of the 2008 Southern Coalfield Inquiry; and
 - strengthen the assessment of the ongoing operation of approved mines and any applications for new mining within the Special Areas of the catchment by providing advice.
- The Panel provided an initial report in December 2018 and a final report in October 2019. The initial report focussed on the impacts of mining at the Dendrobium and Metropolitan Coal Mines, whereas the final report examined the impacts and regulation of mining more broadly and updated the findings of the Southern Coalfield Inquiry.
- The Panel was also empowered to provide advice concerning individual mining applications. PAG wrote to the Panel on 8 November 2019 seeking its advice on Longwall 21 only. The reasons for this limited request are set out under **Section 6** below.
- The Panel sought further information from South32 (via PAG) on 8, 21, 27 and 28 November 2019. South32 provided this information to PAG on 2 and 4 December 2019 and it was in turn provided to the Panel on 4 and 5 December 2019.
- The final package of information provided by South32 and considered by the Panel includes:
 - an updated version of the SMP which includes the WIMMCP and SIMMCP as appendices;
 - the original 7 specialist assessments (3 of which have been subject to minor updates);
 - a total of 53 other specialist studies or other supporting documents which are referred to in the SMP or South32's responses to PAG and the Panel.
- The Panel's final response is considered below.

6. KEY ISSUES

Differences Between the Two Longwalls

- The key differences between the two longwalls include the:
 - proposed orientation of Longwall 20 is roughly parallel to Wongawilli Creek, which substantially increases the length of the creek which may be subject to valley closure, surface cracking and the area of its catchment that may be subject to groundwater depressurisation (and therefore baseflow reduction) and at the same time reduces adaptive management options;
 - centreline of Wongawilli Creek is just 125 m east of the tailgate of Longwall 20 but 240 m west of the finishing end of Longwall 21, at the closest points to the proposed total longwall voids. The closer proximity increases the predicted valley closure; and
 - proposed extraction of Longwall 21 is from east to west, which allows for adaptive management through shortening the longwall ("pulling up short") should subsidence effects in Wongawilli Creek exceed permitted levels.
- For these reasons, advice received from WaterNSW focussed on issues relating to Longwall 20. PAG agrees with this position and considers that Longwall 21 has substantially fewer associated risks.
- Both WaterNSW and BCD sought further consideration by South32 of alternative mine plans and (in BCD's case) alternative mining methods. In its letter to South32 dated 25 November 2019, PAG sought further consideration of the proposed Longwall 20 in respect of 7 key matters, including:
 - what alternative mining layouts had previously been considered;
 - any differences in subsidence effects, impacts and consequences between layouts based on total void width of 256 m and 305 m (as used recently in Area 3B);
 - technically feasible mine design options which would reduce predicted impacts on Wongawilli Creek and the risk of surface-to-seam cracking;
 - potential adaptive management options to ensure that predicted impacts on Wongawilli Creek are not exceeded;
 - further information on geological structures and constraints in the vicinity of Longwall 20. PAG notes that exploration boreholes to the west and northwest of the proposed longwall have

- indicated a large area of the Wongawilli Seam as being consumed by an igneous sill composed of nepheline syenite; and
- an updated Risk Assessment.
- PAG wrote to South32 on 25 November 2019 seeking further information in respect to Longwall 20. South32 responded to this letter on 4 December 2019, providing further information. Nonetheless, due to the elevated risks associated with Longwall 20, PAG considers that the better course of action is to finalise its assessment only in respect of Longwall 21 and to give further consideration to Longwall 20 early in 2020.

Residual Agency Positions

WaterNSW

- In its second advice, dated 5 November 2019, WaterNSW stated that its original concerns over the draft SMP had not been satisfactorily addressed by South32 and continued its objection to the approval of the application, due to “existing and potential impacts of surface-to-seam fracturing on surface water losses. It is the view of WaterNSW that the proposed longwalls pose more than a ‘very low risk of water loss’, particularly for Wongawilli Creek.” WaterNSW proposed that PAG seek independent advice on Longwall 21 and an appropriate setback distance from Wongawilli Creek. PAG has implemented this request by seeking the Panel’s advice.

BCD

- In its second advice, dated 15 October 2019, BCD again sought consideration of alternative mine layouts. PAG has reflected this request in its request for further information from South32 dated 25 November 2019.
- BCD also sought further information on the need for offsets for any impacts to swamps DEN142 and DEN 144; demonstration that offsets to three threatened species associated with swamps (Littlejohn’s Treefrog, Giant Burrowing Frog and Giant Dragonfly) were not required; the uncertain status of a particular Aboriginal heritage site (52-2-0458), which had been previously recorded some 300 m south of the proposed footprint of Longwall 21 but which was not able to be re-identified despite extensive surveys by South32’s Aboriginal heritage consultant; and certain other matters relating to Aboriginal heritage consultation.
- South32 addressed these latter matters in its advice of 7 November.

Panel Recommendations

- PAG has given careful consideration to the 50 recommendations identified in the Panel’s two reports in considering whether to grant approval to the SMP application. On 25 November 2019, PAG sought advice from South32 on which recommendations the company proposed to “adopt or reflect” in the SMP itself and the extraction of the two proposed longwalls. PAG drew particular attention to 15 recommendations, as follows:

Part 1 Report

- Recommendation 5 (*re groundwater monitoring, p 84*)
- Recommendation 8 (*re groundwater modelling, p 85*)
- Recommendation 10 (*re groundwater peer reviews, p 85*)
- Recommendation 14 (*re surface water monitoring, p 113*)
- Recommendation 15 (*re surface water monitoring, p 113*)
- Recommendation 17(i) (*re surface water monitoring, p 113*)
- Recommendation 19(ii) (*re surface water TARPs, p 114*)
- Recommendation 19(iii) (*re surface water TARPs, p 114*)

Part 2 Report

- Recommendation 4 (*re subsidence monitoring, p 19*)
- Recommendation 9 (*re surface and groundwater TARPs, p 40*)
- Recommendation 14 (*re precautionary mine design, p 40*)
- Recommendation 15 (*re surface water flow monitoring, p 40*)
- Recommendation 16 (*re surface water contaminant monitoring, p 40*)
- Recommendation 20 (*re swamp performance and other reports, p 55*)
- Recommendation 23 (*re reliance on remediation, p 67*)
- South32 responded to PAG’s letter on 4 December 2019. A copy of South32’s tabulated response to these 15 recommendations is attached (**Attachment A**). In summary, South32 stated that it was already generally implementing these Panel recommendations. Some were its established practice, and some were still under discussion and development with agencies (eg in relation to additional flow

gauges and review of the WIMMCP and SIMMCP). In a few cases it pointed out limitations on full achievement of the recommendations (eg regarding 4 years of baseline monitoring where changes of mine plan were required due to changed mining conditions or agency requirements).

Panel Advice

- In its advice to PAG regarding Longwall 21 dated 13 December 2019 (**Attachment B**), the Panel summarised its position regarding Longwall 21 as:

“It is possible that LW 21 will result in seam-to-surface connective fracturing over some areas, albeit less extensive than over previous 305 m wide longwalls. In the given site-specific conditions, panel width may need to be reduced to the order of 200 m if seam-to-surface connective fracturing is to be totally avoided.

The SMP is premised on seam-to-surface connective fracturing. On that basis, the Panel considers that in general the supporting analysis is conservative; that is, it errs on the safe side. It concludes that provided the TARPs are effective in giving early indication of an exceedance of performance measures, sufficient to stop longwall mining short of its planned finishing line, LW 21 is amenable to adaptive management.”

- The Panel’s advice reports that the Panel applied the Tammetta equation to calculate a height of fracturing for the 256 m wide longwall void, while also allowing for a 50 m fractured and weathered zone at the surface. The Panel concluded that there would be connective fracturing over the areas of the longwall with a higher depth of cover (ie where the surface topography is higher). However, further consideration of whether seam to surface fracturing would occur was required over the areas of the longwall with shallower depth of cover.
- PAG has considered Drawings 03, 04, 06 and 13 in the SMP’s specialist subsidence assessment (its Attachment D, *Subsidence Predictions and Impact Assessments for Dendrobium LW20 and LW21. MSEC978 Rev E (MSEC 2019)*). These drawings display (respectively) surface topography, seam floor contours (ie seam dip), depth of cover, and predicted vertical subsidence. Drawing 06 indicates that the areas of shallow cover are in the southwestern corner of the longwall. Drawing 13 indicates that subsidence is predicted to be very substantially less in this area than along the longwall’s centreline. That is, MSEC 2019 contains evidence suggesting that the likelihood of connective fracturing over areas of the longwall with limited depth of cover is limited.
- The Panel’s advice also included proposals with respect to the:
 - need for a robust Trigger Action Response Plan (TARP) to allow for adaptive management to stop Longwall 21 if impacts on Wongawilli Creek are trending towards exceedance of performance measures;
 - two particular refinements to the groundwater modelling to be applied in the assessment of Longwall 20;
 - prompt completion of the installation of a flow gauge on Wongawilli Creek to replace the existing WWL gauge (as also recommended by WaterNSW); and
 - four points in regard to proposed swamp monitoring.

7. OTHER FACTORS

- The Dendrobium mine remains a significant contributor to regional employment in the Illawarra, with around 400 people working at the mine, and a further 600 people indirectly reliant on the mine.
- The coal extracted from the mine is a key component in the production of a premium coal blend that is used in steel production at the BlueScope Steelworks in Port Kembla, which employs 3,000 people.
- The 1.4 million tonnes of ROM coal proposed to be recovered from Longwall 21 is estimated by South32 to lead to \$19 million in State Government revenue through royalties, levies and payroll tax.

8. EVALUATION AND CONCLUSIONS

- PAG has assessed the SMP application in accordance with the relevant requirements of the approved consent and has carefully considered the potential impacts of the extraction of Longwall 21 on the surrounding environment. PAG has carefully considered the matters summarised in the foregoing sections of this report.
- Extraction of coal by South32 in Area 3C using longwall methods is already approved under the existing development consent, as modified in 2008. This extraction is subject to the performance measures listed in the consent and to the preparation and approval of an SMP.
- The key matters for consideration by PAG in determining whether to approve the SMP application are whether South32 can meet the two relevant performance measures contained within the development consent. These are that South32 must, to the satisfaction of the Secretary:

- ensure that underground mining operations do not cause subsidence impacts at ... Wongawilli Creek other than "minor impacts" (such as minor fracturing, gas release, iron staining and minor impacts on water flows, water levels and water quality); and
 - ensure the development does not result in reduction (other than negligible reduction) in the quality or quantity of ... surface water inflow to the Cordeaux River at its confluence with Wongawilli Creek.¹
- At the present time, some doubt exists as to whether both of these performance measures can be met if Longwall 20 is extracted as proposed and PAG has therefore sought further information from South32. However, PAG is satisfied that Longwall 21 can be extracted, as proposed under the SMP, with a low risk of exceedance of either of these two performance measures, particularly if the Panel's advice is applied.
 - PAG has carefully reviewed South32's responses dated 7 November 2019 and 2 and 4 December 2019 and considers that they have adequately addressed the concerns raised by government agencies and the questions posed by the Panel. The development consent and previous SMP approvals have established a strict regulatory framework, including stringent performance measures, and comprehensive monitoring requirements.
 - The most significant question to consider *other than* whether South32 can meet its performance measures is the question of the potential for connective cracking, and consequent loss of surface water to the mine. South32's SMP and associated specialist assessments are all predicated on an assumption of connective cracking (ie South32 believes that it can meet its performance measures even in the case of connective cracking).
 - The Panel's advice has applied the Tammetta equation and concluded that areas with high depth of cover will not be subject to connective cracking, even allowing for a 50 m surface zone that is permeable due to weathering and surface cracking. MSEC 2019 contains some evidence that areas with lower depth of cover (say, less than 330 m) also have limited potential to develop connective cracking.
 - While PAG notes the Panel's advice that the areas of the Longwall 21 footprint with limited depth of cover could be considered in more detail, PAG considers that the risk of connective cracking in these areas is limited and is acceptable.
 - Extraction of Longwall 21 would allow the recovery of valuable coal resources, using existing infrastructure and without significantly increasing the existing disturbance footprint within the approved project boundary.
 - Extraction of Longwall 21 would continue to underpin the wide ranging benefits for the local and State economies that derive from the continued operation of the Dendrobium Mine and the part that it plays in supporting the wider coal mining and preparation operations of South32 in the Illawarra Region and the coking coal which it provides for consumption at BlueScope's Port Kembla Steelworks and for export via the Port Kembla Coal Terminal.
 - On balance, PAG considers that the extraction of Longwall 21 SMP application is in the public interest and should be approved, subject to strict conditions as discussed below.

9. RECOMMENDED CONDITIONS

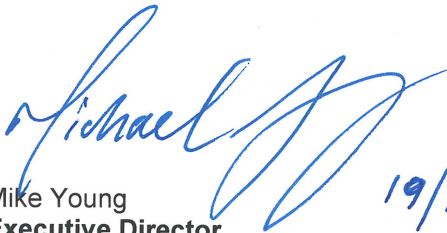
- The consent notes that the Secretary may "*impose conditions containing subsidence impact limits, subsidence management mechanisms or other conditions*" on an SMP (condition 8 of Schedule 3).
- The development consent and previous SMP approvals have established a strict regulatory framework, including stringent performance measures, and comprehensive monitoring requirements.
- The proposed SMP approval has been divided into two key schedules of conditions. The first of these applies to ALL proposed and future longwalls in Area 3C and the second only applies to specific longwalls (in this case the still proposed Longwall 20). The proposed conditions generally reflect those applied to Area 3B, albeit that a number of conditions in the Area 3B SMP approvals only apply to that area (eg in respect of Avon Reservoir) and have no need to be applied in Area 3C.
- A key element of the proposed conditions is a requirement for South32 to submit a revised WIMMCP and SIMMCP for Area 3C to the Secretary for approval by 30 June 2020. The WIMMCP must:
 - be prepared in consultation with WaterNSW;
 - include a TARP which contains quantitative triggers which are directly linked to maintaining achievement of the performance measures for Wongawilli Creek;
 - fully reflect the recommendations of the Independent Expert Panel which directly relate to impact monitoring, management, remediation and contingency planning in respect of watercourses;
 - reflect the nine monitoring program recommendations included in Height of Cracking – Dendrobium Area 3B (PSM, 2018); and

¹ See conditions 2 and 3 of Schedule 3 of consent DA-60-03-2001, as modified.

- include a methodology for developing a rating curve and establishing the relationship between the existing WWL gauge and the new flow gauge required to be constructed.
- Similar requirements apply to the proposed SIMMCP.
- These requirements are the key means by which management and monitoring in respect of Area 3C (and, in particular, Longwall 21) will be made compliant with the recommendations set out in the Panel's final report.
- There are also offset requirements in respect of any:
 - reduction in surface water reporting to WaterNSW storages, consistent with the existing consent, which requires South32 to "provide suitable offsets for loss of water quality or loss of water flows to WaterNSW storages", and the most recent Area 3B SMP approval; and
 - exceedance of performance measures in respect of upland swamps, consistent with the existing Area 3B approval.
- The proposed conditions also reflect all proposals included in the Panel's advice on Longwall 21 and particular requests included in the advice received from WaterNSW.
- WaterNSW was also given the opportunity to review the conditions of the proposed SMP approval before the decision was made. Comments were received on 18 December 2019 and taken into consideration in finalising the conditions.

10. ONGOING MANAGEMENT

- PAG considers that the conditions to be imposed through the SMP approval provide effective safeguards against any significant impacts as a result of the extraction of Longwall 21.
- Further approval will be required before any mining can occur in Longwall 20, following consultation with relevant Government agencies.
- PAG also has a role under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to ensure compliance with the existing development consent and subsequent approvals under the consent.
- In undertaking this role, PAG has a range of enforcement powers available to it if it considers that there may have been or may potentially be a breach of the development consent or subsequent approvals under the consent, including but not limited to, requiring further setbacks from key features or the cessation of mining operations if considered necessary.



Mike Young
Executive Director
Energy & Resource Assessments
as nominee of the Secretary

19/12/19.

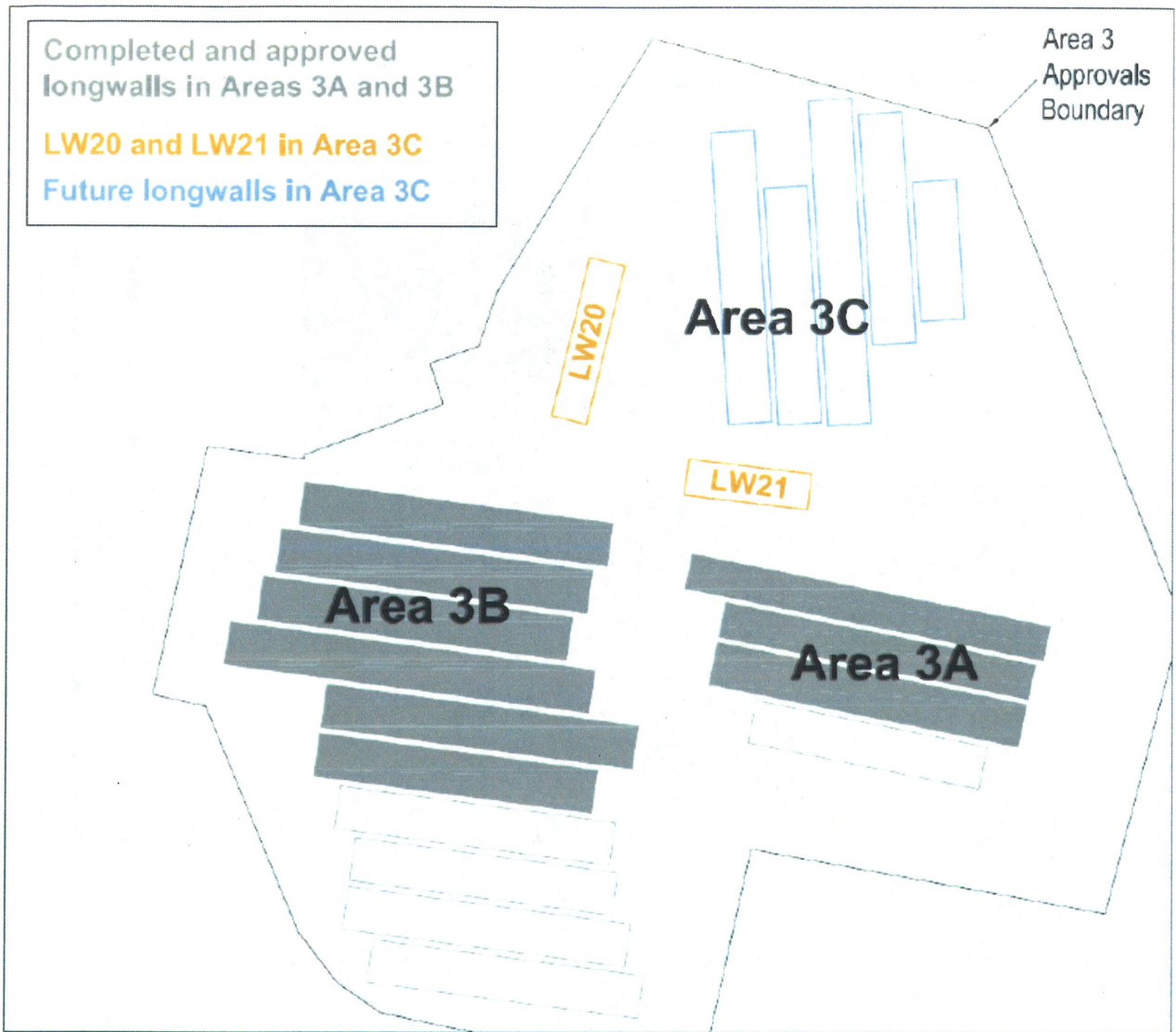


Fig 1: Existing approved Mining Areas 3A, 3B and 3C and existing and proposed longwall extraction

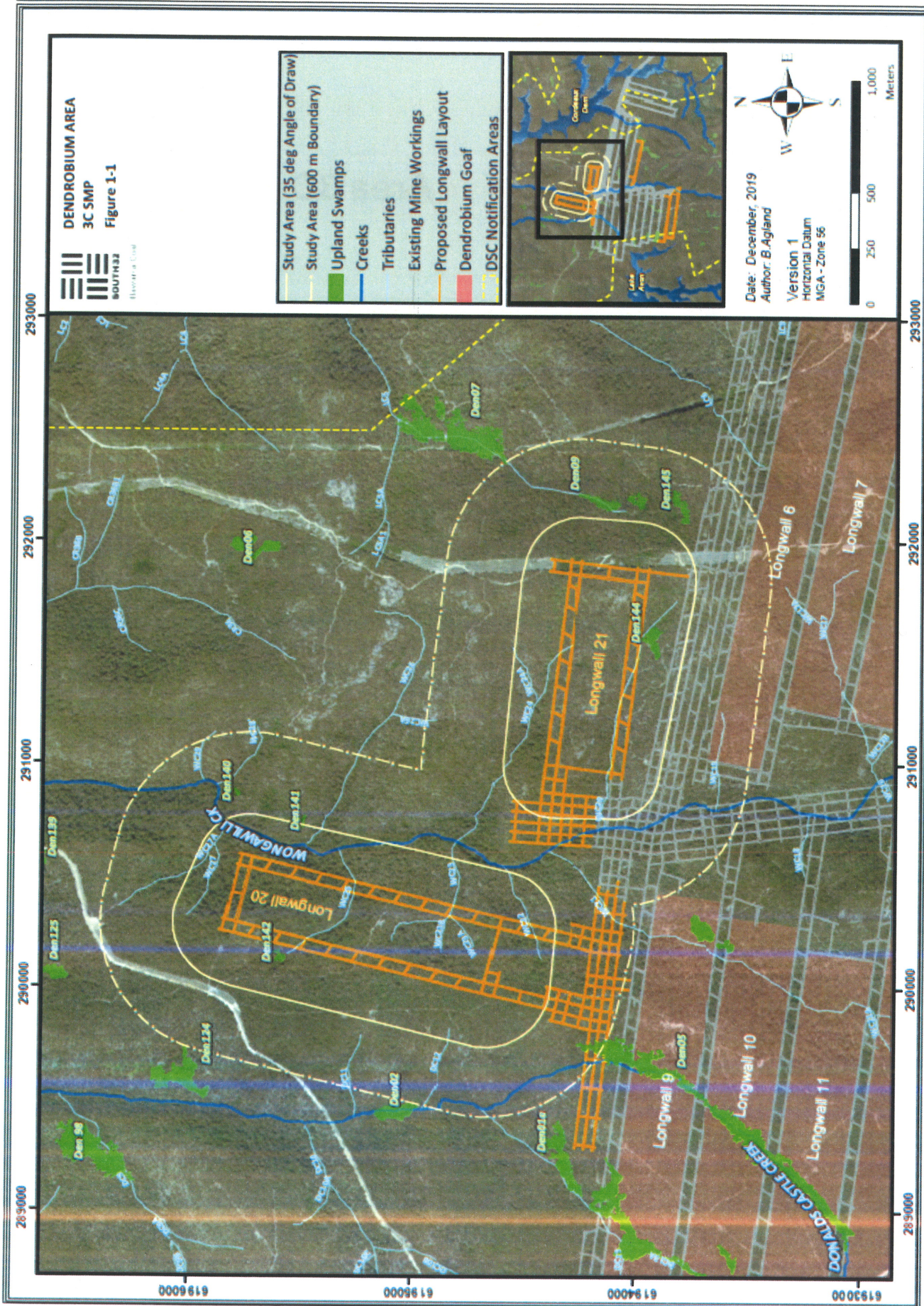


Fig 2: Location of Longwalls 21 and 20.