POWA

Protect Our Water Alliance

18 September 2018

Submission via
https://majorprojects.planningportal.nsw.gov.au/prweb/IAC/Cc0BJSdJ6OdBNUpuWBJD7zYCxcJRCjpn*/!STANDARD?pyActivity=%40baseclass.LaunchOnlineSubmission&ExhibitionID=EXH-1523

Submission OBJECTING to South32's proposed Dendrobium Mine Extension (SSD-8194)

Thank you for the opportunity to make a submission. The Protect Our Water Alliance (POWA) was formed in early 2019 in response to increasing concern about water losses and water quality impacts associated with ongoing mining in Sydney's Water Catchment. Public awareness of the permanent damage caused by mining in the water catchment is growing. Issues of concern are regularly reported in the Sydney Morning Herald, the Illawarra Mercury, ABC radio and through social media. Based in Wollongong, New South Wales, POWA is an alliance of concerned individuals and community groups, and is affiliated with grassroots groups and environmental organisations across the Illawarra, Southern Highlands, and Greater Sydney regions. POWA is not associated with any political party and has not made any political donations.

The Dendrobium Mine Extension Project proposes 29 years of longwall coal mining in the water catchment for Wollongong, Macarthur and Sydney. It will result in damage in the catchment, and losses of water from swamps, water courses, groundwater and the Avon, Cordeaux and Nepean Reservoirs.[1] Australia is the driest continent on earth and yet Sydney seems to be the only city in the world that allows longwall mining in a publicly-owned water catchment.[2] The proposed mining expands on existing already-damaging longwall coal mining in the protected Metropolitan Special Area of the water catchment. Five million people rely on the Sydney Water Catchment for their drinking water. NSW is currently mostly in drought, and we live in a climate crisis where there is as yet, no guaranteed or even likely clear limit to anthropogenic global warming. But we can expect hotter conditions and more extreme weather events – and for water to become ever more precious. This project would contribute further significant greenhouse gas emissions, while at the same time permanently damaging the water catchment and undermining our water supply.

POWA very strongly objects to South32's Dendrobium longwall coal mining extension proposal. We call on the Planning Minister to reject this proposal, and instead actively plan and prepare for the permanent closure and remediation of Dendrobium Colliery over the next decade.

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[1] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. South32 (2019) Section 6. Environmental Assessment. pp 6-33 – 6-69. Accessed 01/09/2019 from https://www.planningportal.nsw.gov.au/major-projects/project/9696

[2] NSW Chief Scientist & Engineer (2014) *On measuring the cumulative impacts of activities which impact ground and surface water in the Sydney Water Catchment*. p A-27. Accessed 16/09/2019 from https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0007/44485/140530_SCA-Report-Final-Combined.pdf

Further, we call on the NSW government to provide wide-ranging support to assist Dendrobium mine workers so they can transition to new sustainable employment over the coming years.

POWA has engaged the Environmental Defenders Office NSW (EDO-NSW) to provide expert advice related to this proposal. We object to the proposed Dendrobium Mine Extension on many grounds. We provide our reasons below, and we also submit the expert reports provided for us by EDO-NSW.

South32 frames this proposal in a false and misleading way. This is not a choice between supporting steel manufacture in Australia or not. This is a choice between allowing a 29-year longwall coal mining expansion in the Metropolitan Special Area or not. This proposal is not a plan for the future – rather it is a plan for prolonging a destructive and dangerous status quo.

We find that the proposal title – *Dendrobium Mine – Plan for the Future: Coal for Steelmaking* – is misleading, and part of a broader attempt to falsely spin the proposed 29-year longwall coal mine expansion by framing the project as necessary for continued steel production in Australia. This proposal is not a plan for the future. South32 is not proposing the project out of a charitable corporate impulse to support Australian steel manufacture. Rather, this is a request by South32 to moreorless continue their status quo, making money with no regard for our climate crisis and little regard for the people, ecosystems and species that rely on the Sydney Water Catchment or Metropolitan Special Area.

Coking coal is not absolutely necessary for steel production. Currently about 26 % of the world's steel is made without coking coal.[3] And technological innovations are currently underway that will likely make *green* steel produced without the use of coking coal or any fossil fuels (*e.g.* Hybrit[4]) competitive on a cost-basis within the next decade.[5] It is time that Australian steelmakers sought to shift from traditional old blast furnace (fossil-fuel reliant) technologies and transition to steel produced using renewable energy only. There is a role for state and federal government to assist with this.[6] It is not as if global warming caused by climate change is a sudden revelation within the past year. Corporate entities (including steel manufacturers) and governments have had at least thirty years to plan for doing their part to contribute significantly to emissions reductions and to manage associated risks. It is time to be responsible and face up to the challenges of the future.

South32 makes much of the fact that it supplies BlueScope Port Kembla steelworks however, we note that BlueScope itself prepares some coke for export, so though BlueScope might purchase coking coal/PCI from Dendrobium, not all of it is used to make steel locally.

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[3] Point 547 by Justice Brian Preston indicates that 74 % of the world's steel is made using the BOF process relying on coking coal. In Gloucester Resources Limited v Minister for Planning [2019] NSWLEC 7. Accessed 10/08/2019 from https://www.caselaw.nsw.gov.au/decision/5c59012ce4b02a5a800be47f

[4] See http://www.hybritdevelopment.com/ and see https://www.ssab.com/company/newsroom/media-archive/2019/09/13/10/21/ssab-lkab-and-vattenfall also.

[5] As outlined by Dr John Pye during his recent presentation at the ANU Energy Change Institute *Green Steel* 27/08/2019 event video. Accessed 29/08/2019 via https://www.facebook.com/ANUEnergyChange/

[6] See the plan/strategies/policies in Beyond Zero Emissions (2018) *Zero Carbon Industry Plan: Electrifying Industry*. Accessed 15/09/2019 from https://bze.org.au/research/manufacturing-industrial-processes/electrifying-industry/

The project would result in very large quantities of greenhouse gas emissions at a time when globally we need to rapidly reduce emissions and transition away from coal to avoid disastrous climate change.

South32 already has development consents relating to Dendrobium that will last until 2030. There are eleven further longwalls already approved and remaining to be mined – one in Area 3A, three in Area 3B and seven in Area 3C. The proponent expects to extract 34.7 Mt ROM coal from these already approved longwalls.[7]

This extension proposal is to expand longwall mining into the next two areas: Area 5 and Area 6, while continuing and extending the duration of mining in the remaining approved areas.[8] The project will produce coking (*metallurgical*) and thermal (*energy*) coal products:

> The Project seeks to extract an additional 77.6 million tonnes (Mt) of run-of-mine (ROM) coal from Area 5 and Area 6, at an extraction rate of up to approximately 5.2 Mt of ROM coal per annum, over the period 2020 to 2048. The Project will produce 64.6 Mt of saleable coal, which includes 48.8 Mt of high-quality metallurgical coal. The remainder is made up of thermal coal and Pulverised Coal Injection (PCI) coal, 6.2 Mt and 9.6 Mt respectively.[9]

Based on these figures, the mine extension (Area 5 and Area 6) will produce 9.6 % thermal coal, and 75.5 % coking coal and 14.9 % PCI which can both be used in steel production. There will also be an additional 13 Mt of ROM coal waste materials associated with Area 5 and Area 6.

IF this project is approved, then the total reported Scope-1, Scope-2 and Scope-3 emissions associated with Dendrobium operations over the life of the project are estimated to be 22, 1.7 and 237 Mt CO2e, respectively – amounting to 261 Mt CO2e altogether.[10] If this project is not approved, then nonetheless there will be continued emissions associated with the mining of the already approved longwalls, and combustion of the mined coal (either in Australia or internationally). The proponent also indicates that the mine would likely close in 2026 if this extension proposal is not approved.

Based on the total estimated greenhouse gas emissions (261 Mt CO2e) for the project, and assuming that mining, production and combustion of the already approved Area 3 coal will generate similar amounts of greenhouse gases on a per Mt ROM coal extracted basis as for coal from Areas 5 and 6, then we estimate that the total emissions associated with the Area-3 would be about 81 Mt CO2e and about 180 Mt CO2e for the Area-5 and Area-6 extractions. Unfortunately, even without approval of this extension, Dendrobium will be still contribute significant total emissions.

South32 appears to consider the estimated average annual Scope-1 emissions (at about one-twohundredth of NSW's and one-eighthundredth of Australia's 2016 reported emissions) as not really that significant. Yet we consider they are very significant for a single corporation's single mining operation. Given Australia's growing population and infrastructure needs (e.g. to assist with transitioning to renewable energies, transport, repairing/maintaining water/stormwater networks,

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[7] Calculated from *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix I: - Air Quality and Greenhouse Gas Assessment. Ramboll (2019) *Air Quality and Greenhouse Gas Assessment.* p 65. Table 8-3. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[8] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. South32 (2019) Executive Summary. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[9] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix L: Economic Assessment. Cadence Economics (2019) *Economic Impact Assessment of the Dendrobium Mine.* p iii. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[10] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix I: - Air Quality and Greenhouse Gas Assessment. Ramboll (2019) *Air Quality and Greenhouse Gas Assessment.* p 62-65. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

coping with natural and climate-related disasters, etc) over the next 29 years, should the NSW government on behalf of Australia really allocate (allow) more than one-eighthundredth of our permitted greenhouse gas emissions to be expended at Dendrobium mine?

In fact, if Australia honours its international greenhouse gas emissions commitments and reduces emissions by 26-28 % below 2005 levels by 2030, then then the proposed Dendrobium Scope-1 emissions will become even more significant. Australia's annual emissions in the years 2005 and 2016 were 617.416 and 529.931 Mt CO2e, respectively.[11] Based on these figures, in 2030, Australia can emit no more than 456.888 Mt CO2e. The project's estimated average annual Scope-1 emissions of 0.77 Mt CO2e would then constitute 1.7% of Australia's total permissible emissions (equivalent to more than one-sixhundredth).

The NSW government has declared its own goal of no net greenhouse gas emissions by 2050. This will not happen without detailed careful planning for where and when emissions would be allocated and allowed. It is already urgent that future permitted emissions are allocated to projects that precisely assist with the required societal and industrial transition away from fossil fuels (rather than to ones that prolong the status quo).

However, this focus so far on the proposed Sope-1 emissions ignores the much larger Scope-3 emissions which South32 would have the community and NSW Department of Planning ignore, or at least not consider South32 as having any responsibility for. We note that some of the very significant expected coal-combustion Scope-3 emissions – that is, 237,000,000 tonnes CO2e – will occur here in NSW at BlueScope Port Kembla, and some in Whyalla, South Australia, and some overseas. We were not clear from the provided documents exactly how much of the extracted coal would be burned where. But POWA considers that Australia (and NSW) should take responsibility and consider **all** emissions, including these Scope-3 emissions, regardless of whether they occur here in NSW, in South Australia or overseas.

The IPPC 2018 Special Report explored various energy policy scenarios in relation to their effects on global warming. The report indicates that to limit warming to 1.5^{o}C then, globally, by 2030, primary energy from coal needs to have reduced by a minimum of 59 %.[12] In this context, this coal mining extension proposal spanning 29 years should not be allowed.

Australia is a major greenhouse gas polluter. Based on the 2016 year, Australia had higher emissions than 90 % of countries and had the seventh highest emissions per capita.[13] However, Australia as an exporter of greenhouse gas emissions was even worse and ranked third after Russia and Saudi Arabia for exports of fossil fuel CO2e potential. Coal makes up more than 80 % of this export.[14] Australia's significance as a coal exporter gives Australia (and NSW) an opportunity and

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[11] http://ageis.climatechange.gov.au/

[12] Figure SPM.3b, p14 IPCC (2018) *Summary for Policymakers*. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. Accessed 03/09/2019 from: https://www.ipcc.ch/sr15/chapter/spm/

[13] T. Swann (2019) *High Carbon from a Land Down Under*. The Australia Institute. Accessed 01/09/2019 from: https://www.tai.org.au/sites/default/files/P667%20High%20Carbon%20from%20a%20Land%20Down%20Under%20%5BWEB%5D_0.pdf

[14] T. Swann (2019) *High Carbon from a Land Down Under*. The Australia Institute. Accessed 01/09/2019 from: https://www.tai.org.au/sites/default/files/P667%20High%20Carbon%20from%20a%20Land%20Down%20Under%20%5BWEB%5D_0.pdf

obligation to behave more responsibly in future. Australia needs to take responsibility not only for its domestic emissions but also for its exported (Scope-3) emissions arising from coal.

Justice Brian Preston supported climate responsibility in his judgement against the Rocky Hill mine, citing the mining SEPP Clause 14 (2): *"... the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development.*"[15] He considered that both direct and indirect (Scope-3) emissions should be considered, and took issue that no specific proposal had been provided to offset of these emissions,[16] as is also the case here for the proposed Dendrobium extension. The Rocky Hill judgment also concluded that producing coking (rather than thermal) coal was not a justification for greenhouse gas emissions.[17] POWA agrees wholeheartedly with this judgment.

We also submit the arguments put forward by Professor John Quiggin of the University of Queensland (please see his complete comments attached at the end). He points out that much of the Scope-3 emissions associated with this project, if used to support Australian steel manufacture as argued by the proponent, will in fact contribute to Australia's domestic emissions over years to come – and so should be considered at the very least on that basis by NSW decision makers. He also shows South32's use of the ERF price for estimating the cost of damage associated with greenhouse gas emissions to be ludicrously unreal.

Greenhouse gas emissions associated with transport of mined coal (internationally or within Australia) are not estimated in the proposal. These would be additional to the Scope-3 coal-combustion emissions.

We note that the proposal's greenhouse inventory[18] does not include emissions associated with product coal transport beyond Port Kembla. This excludes international sea-transport and subsequent on-land emissions, as well as emissions associated with transport to Whyalla. While we understand that South32 might not know who is going to purchase their product coal in the future, these domestic/international shipping/land transport emissions would be additional Scope-3 emissions occurring over the life of the mine, and we wonder about their magnitude relative to included Scope-1 component emissions, and relative to the main coal-combustion Scope-3 emissions. What are the average international-transport-related emissions per million tonnes of exported coal associated with South32's coal exports over the past five years for instance? And what is the similar average for transport to Whyalla? These could be scaled by the expected number of million tonnes to be exported or to be used by Whyalla over the life of the project to obtain relevant transport-beyond-the-terminal emissions estimates.

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[15] Gloucester Resources Limited v Minister for Planning [2019] NSWLEC 7. Item 491. Accessed 01/09/2019 from: https://www.caselaw.nsw.gov.au/decision/5c59012ce4b02a5a800be47f#_Toc431203

[16] Gloucester Resources Limited v Minister for Planning [2019] NSWLEC 7. Items 486, 529. Accessed 01/09/2019 from: https://www.caselaw.nsw.gov.au/decision/5c59012ce4b02a5a800be47f#_Toc431203

[17] Gloucester Resources Limited v Minister for Planning [2019] NSWLEC 7. Item 546. Accessed 01/09/2019 from: https://www.caselaw.nsw.gov.au/decision/5c59012ce4b02a5a800be47f#_Toc431203

[18] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix I: - Air Quality and Greenhouse Gas Assessment. Ramboll (2019) *Air Quality and Greenhouse Gas Assessment.* p 62. Table 8-1. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

Through its damage of the water catchment, the project will likely also contribute to loss of currently sequestered carbon and also to a reduction in carbon sequestration capacity of the catchment project area. These long-term greenhouse gas emission impacts, extending well beyond the life of the mine, are not considered in the proposal. Furthermore, as well as directly damaging upland swamps, the proposal through its greenhouse gas emissions indirectly threatens their existence.

We notice that there is no consideration of the additional greenhouse gas emissions that would occur through landform changes caused by subsidence, other surface damages and associated water losses. The rainforests, forests, tall trees, bush, and swamps as they are, currently hold carbon – sequestered in living and nonliving materials. Damage inflicted on the catchment will likely cause release of some currently sequestered carbon to the atmosphere. Loss of water from the area also means that it is more prone to bushfires which would only also further release carbon to the atmosphere. The damage to the catchment is permanent. These damages will likely mean that there is also a reduction in future carbon sequestration capacity, especially as trees and shrubs die. The NSW government should not allow this!

The proposed Dendrobium mine extension will further damage the water catchment and devastate ecosystems contained within it. Approval will further reduce catchment water supply and water quality. POWA submits that no more damage to the water catchment is acceptable and no further water losses are acceptable.

Some people involved with POWA, earlier this year met with the IEPMC following the release of their report from 2018. These were mostly middle-aged or older people who have witnessed the NSW government hold various inquiries and commission various reports investigating damage caused by coal mining in the Sydney Water Catchment. These individuals or various community group representatives (some of whom are now part of POWA) have heard the same thing many times – that longwall coal mining damages the water catchment – but have not seen any effective corrective action taken by the NSW government. The damage and destruction continue. Independently of each other, we asked the IEPMC in one way or another, just to recommend a complete halt to coal exploration and mining in the water catchment, as that was the only sure way to prevent further destruction. POWA does not consider that any further damage can be justified.

There is a real weariness among POWA members. Some in our Alliance have engaged consistently and conscientiously with the NSW government for more than a decade. Understandably they are frustrated and distressed, because they feel their efforts to raise awareness and to protect the catchment have been in vain. They share personal knowledge, photos and reports within POWA. POWA members are aware of so many reports documenting that coal mining damages the water catchment, that it causes subsidence effects and losses of ground water and surface water – all with terrible consequences for upland swamp ecosystems in particular. But what use are government or expert reports without appropriate follow-on actions? We have compiled a box, below, which provides a partial list of reports which our members refer to. Some reports document that more damage occurs than is outlined in proponents' environmental impact statements provided at the planning assessments/approvals stage. Importantly the recent 2016 WaterNSW-commissioned audit[19] pointed out that many of the reports that it reviewed were not peer-reviewed and that many

[19] Advisian (2016) *Literature Review of Underground Mining Beneath Catchments and Water Bodies*. Report for WaterNSW by Advisian, J. Ross, PSM, Mactaggart & Grant Sutton & Assoc. December 2016. p S1. Accessed 17/09/2019 from:

were written by consultants for mining companies on a commercial basis. Nonetheless various reports show that longwall coal mining (as proposed here) is particularly damaging. Various reports also importantly tell us that there is not enough information about involved systems to be able to predict damages caused by coal mining with any certainty.[20]

Some reports ordered by year…

NSW Scientific Committee, Department of Environment & Climate Change (2005) *Determination on Longwall Mining as a Key Threatening Process. Alteration of habitat following subsidence due to longwall mining key threatening process listing*. Available at: https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2004-2007/alteration-of-habitat-following-subsidence-due-to-longwall-mining-key-threatening-process-listing

McNally, G., and Evans, R. (2007) *Impacts of longwall mining on surface water and groundwater, Southern Coalfield, NSW.* Report prepared for NSW Department of Environment and Climate Change: eWater Cooperative Research Centre, Canberra. Available at: https://ewater.org.au/uploads/files/McNally_Evans-2007-Longwall_mining.pdf

Department of Planning (2008) *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield: Strategic Review*. Available at: https://trove.nla.gov.au/work/33850884?q&versionId=41652064

Dams Safety Committee (2010) *Mining near Prescribed Dams – Mining Applications*. Document DSC4B, June 2010. Available at: http://www.damsafety.nsw.gov.au/DSC/Download/Info_Sheets_PDF/Mining/DSC4B.pdf

OEH (Office of Environment and Heritage) (2011) *Alteration of habitat following subsidence due to longwall mining – key threatening process listing: NSW Scientific Committee – final determination*. March 2011. Available at: http://www.environment.nsw.gov.au/determinations/LongwallMiningKtp.htm

NSW Scientific Committee, Department of Environment & Climate Change (2012) *Coastal Upland Swamp in the Sydney Basin Bioregion - endangered ecological community listing - NSW Scientific Committee - final determination*. Available at: https://www.environment.nsw.gov.au/determinations/coastaluplandswampfd.htm

Department of the Environment (2013) *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments - impacts on water resources*. Available at: http://www.environment.gov.au/system/files/resources/d078caf3-3923-4416-a7430988ac3f1ee1/files/sig-water-resources.pdf

Pells, S.E. & Pells, P.J.N.P. (2013) *Three-dimensional groundwater model of Hume Coal Prospect, Southern Highlands NSW.* Draft consultant's report by Pells Consulting for Southern Highlands Coal Action Group. Ref P029.R1 3 October 2013. Available at: http://www.pellsconsulting.com.au/downloads/threeDimensionalGroundwaterModelOfHumeCoalProspect.pdf

Tammetta, P. (2013) *Estimation of the Height of Complete Groundwater Drainage Above Mined Longwall Panels.* Ground Water 2013 Sep-Oct;51(5):723-34. Available at: https://www.ncbi.nlm.nih.gov/pubmed/23206210

Tammetta, P. (2014) *Estimation of the Change in Hydraulic Conductivity above Mined Longwall Panels*. Ground Water 2015 Jan-Feb;53(1):122-9. Available at: https://www.ncbi.nlm.nih.gov/pubmed/24405232

NSW Chief Scientist & Engineer (2014) *On measuring the cumulative impacts of activities which impact ground and surface water in the Sydney Water Catchment.* Available at: https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0007/44485/140530_SCA-Report-Final-Combined.pdf

Commonwealth of Australia (2014) *Temperate Highland Peat Swamps on Sandstone: ecological characteristics, sensitivities to change, and monitoring and reporting techniques. Knowledge report*. Prepared by Jacobs SKM for the Department of the Environment, Commonwealth of Australia. Available at: http://www.environment.gov.au/system/files/resources/1fd762d9-7e35-4299-ba5779297d735487/files/peat-swamp-ecological-characteristics.pdf

IESC (2014) *Background review: Subsidence from coal mining activities*. Report by Jacobs/SKM and MSEC. Available at: http://www.environment.gov.au/system/files/resources/1ebc143e-e796-453d-b9d6-00cdbbabdee3/files/background-review-subsidence-coal-mining.pdf

IESC (2015) Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development. *Advice to decision maker on coal mining - IESC 2015-068: Further advice on impacts to swamps*. Available at: http://www.iesc.environment.gov.au/system/files/resources/515be156-1fac-4d2f-86a1-f8a3e4918298/files/iesc-advice-swamps-2015-068.pdf

Advisian (2016) *Literature Review of Underground Mining Beneath Catchments and Water Bodies*. Report for WaterNSW by Advisian, J. Ross, PSM, Mactaggart & Grant Sutton & Assoc. December 2016. Available at: https://www.waternsw.com.au/__data/assets/pdf_file/0011/127559/20161223-WaterNSW-Literature-Review-Underground-Mining-V3.pdf

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https://www.waternsw.com.au/__data/assets/pdf_file/0011/127559/20161223-WaterNSW-Literature-Review-Underground-Mining-V3.pdf

[20] For example, IESC (2015) Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development. *Advice to decision maker on coal mining - IESC 2015-068: Further advice on impacts to swamps*. p 2. Available at: http://www.iesc.environment.gov.au/system/files/resources/515be156-1fac-4d2f-86a1-f8a3e4918298/files/iesc-advice-swamps-2015-068.pdf & IEPMC (2018) *Initial Report on Specific Mining Activities at the Metropolitan and Dendrobium Coal Mines*. Report by the Independent Expert Panel for Mining in the Catchment for the NSW Department of Planning and Environment. 12 November, 2018. Available at: https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0008/209357/IEPMC-Report_Term-of-Reference-1.pdf

Tammetta, P. (2016) *Estimation of the Change in Storage Capacity above Mined Longwall Panels*. Ground Water 2016 Sep;54(5):646-655. Available at: https://www.ncbi.nlm.nih.gov/pubmed/26789135
PSM (2017) *Height of Cracking – Dendrobium Area 3B*. Report for the Department of Planning and Environment, doc PSM3021-002R.
IEPMC (2018) *Initial Report on Specific Mining Activities at the Metropolitan and Dendrobium Coal Mines*. Report by the Independent Expert Panel for Mining in the Catchment for the NSW Department of Planning and Environment. 12 November, 2018. Available at:
https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0008/209357/IEPMC-Report_Term-of-Reference-1.pdf
IESC (2018) *Update to the Information Guidelines for proponents preparing coal seam gas and large coal mining development proposals*. Available at: http://www.iesc.environment.gov.au/system/files/pages/b0d7d714-6d6e-4cec-adeb-a27012871522/files/draftupdate-iesc-information-guidelines.pdf

We also note that no POWA person has ever found or shared a report that indicates that coal mining in the catchment benefits the water catchment, its ecosystems, habitats or species survival, or that coal mining in the catchment protects or enhances water supplies or improves stored water quality. None of these listed reports (or other reports that we are aware of) say that.

The reports that are already out there, consider that longwall coal mining causes the types of damage anticipated in the proposal,[21] namely:

- Vertical subsidences: for example, 2.05 m expected above Area 5 proposed longwalls & 2.45 m expected above Area 6 proposed longwalls. But based on past experiences these are likely conservative estimates!
- Tilt, hogging, sagging curvatures
- Closures of creeks
- Fracturing along streams; fracturing of bedrock; fracturing/instability of cliffs
- Tension cracks at tops of rock outcrops
- Buckling of bedrock at bottoms of rock outcrops
- Compression ridges at bottoms of steep slopes
- Surface deformations with crack widths typically 100-150 mm wide, but as much as 400 mm wide (as already previously observed at Dendrobium).

These past government reports also talk about destruction of threatened upland swamp ecosystems and collapses of cliffs. The proponent's *Subsidence Assessment*[22] states that there are 46 upland swamps in the study area (the area defined as likely to experience impacts) with 26 of these upland swamps partially or entirely located above the proposed longwalls. These 26 are expected to experience the full range of predicted movements and resulting damage. There are also 40 cliffs directly above the proposed Area 5 longwalls. Further, according to the project's *Groundwater Assessment* [23] the proposed Area 5 is only 300 m from Avon Reservoir at the closest (with an average lateral distance 400-600 m); and the proposed Area 6 is only 630 m from Cordeaux Reservoir at the closest (with an average lateral distance 950 m). The *Subsidence Assessment* further documents that:

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[21] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix A: Subsidence Assessment. Mine Subsidence Engineering Consultants MSEC (2019) *Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Environmental Impact Statement Application.* pp i-v. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[22] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix A: Subsidence Assessment. Mine Subsidence Engineering Consultants MSEC (2019) *Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Environmental Impact Statement Application.* pp i-v. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[23] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix B: Groundwater Assessment. HydroSimulations (2019) *Groundwater Assessment.* p 19. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

> natural and built features within or in the vicinity of the Study Area include the Avon River, the Cordeaux River, Wongawilli Creek, Donalds Castle Creek, drainage lines, cliffs, minor cliffs, steep slopes, swamps, disused railway corridor, Picton Road, unsealed tracks, gas pipelines, 330 kV transmission line, 33 kV powerline, Avon and Cordeaux Reservoirs and associated dam walls, Aboriginal heritage sites, historical heritage sites, survey control marks, buildings and other structures.

The NSW government should not allow any risk of further damage to any and all of these!

The past reports describe how longwall coal mining causes subsidence and fracturing that can reach the land surface. This geological structural fragmentation changes how water flows through and into the catchment landscape. The result is water is *lost* from the catchment ecosystems and from the catchment water supply.

South32's proposal cannot avoid anticipating damage to the water catchment given the literature and experiences already known. However, POWA finds South32's proposal to offset catchment land or upland swamps[24] to be preposterous. There is no equivalent land that could compensate for the damage and compromised water catchment. There will be no way to compensate or replace destroyed upland swamps. The company could not afford to attempt to truly cover the related social/environmental/economic costs borne by NSW residents (now and in the future).

POWA further notes that the *Aboriginal Cultural Heritage Assessment*[25] based on records and on a physical survey of only 6.91 % of the affected area, identified 58 Aboriginal heritage sites, including six new sites, in the area likely to be affected by longwall mining in Area 5 and Area 6. These are mostly rock shelters with/without art and deposits, and axe grinding groove sites located in creeks. All sites have profound cultural significance. The report identified six as having high scientific significance as well. Many of these sites date back 2000 years and testify to the lives of Tharawal peoples who distinguished themselves as Fresh, Bitter or Salt Water people. These sites and related knowledge are understandably so precious to living Indigenous Australians that much information about them is not included in the public report. The report acknowledges that all sites are potentially subject to subsidence effects. Previous experience suggests that one in ten rock-based sites will be impacted. This poses the destruction of indigenous cultural landscapes: rock shelters may collapse, and even if they avoid being directly broken, axe grinding groove sites might no longer receive surface water stream flow to work. This is not acceptable. Modern Australians are the beneficiaries of more than 60,000 years of caring for country by Indigenous Australians. We need to acknowledge our deep debt to them, and show more respect than to risk the destruction potential associated with this Dendrobium proposal.

The proposed Dendrobium mining expansion is in the protected Metropolitan Special Area of the water catchment, with Area 3 (remaining approved longwalls) and Area 5 located between the Avon and Cordeaux Reservoirs, and with Area 6 located east of the Cordeaux River and north-west of Cordeaux Reservoir itself.[26] Water inflows into the mine are expected to be as much as 26 ML/day equivalent to 9,490 ML/year, and even in an extended drought scenario, 22 ML/day of

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[24] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. South32 (2019) *Section 6: Environmental Assessment*. pp 6-64–6-67. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[25] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix F: Aboriginal Cultural Heritage Assessment. Niche Environment & Heritage (2019) *Aboriginal Cultural Heritage Assessment.* pp 26,33-34, 68, 71-72. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[26] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. South32 (2019) *Executive Summary,* Figure ES-1. p ES-2. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

water (8,030 ML/year) could still be lost.[27] This mine-inflow depletes overlying ground waters (causing drawdowns to various extents in aquifer strata above) and surface waters. Dendrobium mine as a whole will likely result in 1300-1400 ML/year stream flow losses in each of the Cordeaux River and Avon River catchments.[28] The Reservoir water losses are estimated to be 0.29 ML/day from the Cordeaux, 0.48 ML/day from the Avon, and at least 0.02 ML/day (base-case estimate) from the Nepean[29].

POWA asserts that these water losses are significant now and will only become even more significant as the climate warms and weather becomes more extreme. Evapotranspiration rates will be higher and heat-stressed humans and ecosystems will have higher (rather than lower) water needs. Over the past wet day[30] the Greater Sydney Catchment supplied 1,237 ML to about 5 million residents and users. The 9,490 ML/year estimated to be lost down the proposed Dendrobium expansion is more than 7 days' worth of today's water use. It equates to the loss of daily drinking water supply for more than 120,000 Sydney residents.[31] Despite the welcome rain today, Sydney and most of NSW is in drought, and some parts are on fire in an early fire season. Water is also necessary for preventing and combatting fires. Sydney residents are paying for desalinated water and our dam levels are around or below 50%. The Dendrobium proposal has the highest water loss of any mine operating in the Greater Sydney Water Catchment area. It makes no sense to approve this mine expansion in any form.

The proposed Dendrobium mine extension will likely contribute to further water pollution in the Sydney Water Catchment with adverse impacts on water ecology. These are inadequately considered or addressed within the proposal.

We submit the statement provided by Dr Ian Wright from Western Sydney University who considers that potential water pollution and related impacts on water ecology are inadequately addressed within the proposal. Dr Ian Wright has spent several years investigating and documenting water quality issues related to mining in the water catchment. His complete statement is provided at the end (Appendix B).

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[27] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix B: Groundwater Assessment. HydroSimulations (2019) *Groundwater Assessment.* p 93-103. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[28] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix B: Groundwater Assessment. HydroSimulations (2019) *Groundwater Assessment.* p 99. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[29] *Dendrobium Mine – Plan for the Future: Coal for Steelmaking*. Appendix B: Groundwater Assessment. HydroSimulations (2019) *Groundwater Assessment.* p 101. Accessed 01/09/2019 from: https://www.planningportal.nsw.gov.au/major-projects/project/9696

[30] Snapshot of Sydney Water Catchment status and supply taken at 11:47am on 18/09/2019) from: https://www.waternsw.com.au/supply/drought-information/greater-sydney/greater-sydney-catchment

[31] Based on 210 L/person per day from I. Wright (2019) *Why Sydney residents use 30 % more water per day than Melburnians*. The Conversation. Accessed 05/09/2019 from http://theconversation.com/why-sydney-residents-use-30-more-water-per-day-than-melburnians-117656

POWA opposes the Dendrobium coal mining expansion project. The NSW government, Department of Planning cannot claim ignorance about climate change and greenhouse gas emissions, nor about the destruction of upland swamps caused by coal mining in the Sydney Water Catchment. This project will produce vary large emissions and will damage and destroy parts of the water catchment. This project is not in the public interest. It would be reckless and immoral for the NSW Department of Planning to allow this expansion. We ask that you reject this application from South32/Illawarra Coal and instead plan the process to close the mine at Dendrobium permanently over the coming decade. We further ask that the NSW state government works together with the Commonwealth and other state/territory governments to assist with the transition away from coking coal in steel manufacture in Australia. We recommend the Beyond Zero Emissions (2018) *Zero Carbon Industry Plan: Electrifying Industry* report[32] especially where it documents a way forward to electrifying Australia's industries. This truly is a plan for a good future for Australia.

Finally, we refer you to other supporting statements, obtained for POWA through the efforts of NSW-EDO. These are from Professor John Quiggin from the University of Queensland (Appendix A) and Dr Ian Wright from Western Sydney University (Appendix B), and follow below.

Thank you for considering this submission.

[32] Beyond Zero Emissions (2018) *Zero Carbon Industry Plan: Electrifying Industry.* See especially sections A4 Road to Renewables and A5 Making it happen. pp 34-48. Accessed 15/09/2019 from https://bze.org.au/research/manufacturing-industrial-processes/electrifying-industry/

APPENDIX A: STATEMENT BY PROFESSOR JOHN QUIGGIN

School of Economics, University of Queensland.
https://economics.uq.edu.au/profile/2249/john-quiggin

Dendrobium Mine Environmental Impact Statement: comments

This project involves the extraction of metallurgical coal from the Dendrobium mine near Port Kembla, with the primary economic purpose of supplying the nearby Bluescope steel works, with additional supplies going to Whyalla and a residual being exported overseas. Based on this information, the great majority of the greenhouse gas emissions associated with the project will take place within Australia, primarily within NSW. Despite this, the environmental impact statement seeks to disregard approximately 99.99 per cent of the greenhouse gas emissions generated by the project and the coal it produces. This startling outcome is achieved in two steps.

First, 'Scope 3' emissions, that is, those associated with the burning of coal are disregarded on the basis of the principle, set out in the Paris agreements, that each country is responsible only for emissions generated within that country. This argument has been used by projects producing coal for export to argue that their Scope 3 emissions should be disregarded. However, this argument is obviously not applicable to the Dendrobium project, which is directly linked to the burning of coal within Australia. As shown in Table 8-3 of Appendix I, Scope 3 emissions account for approximately 90 per cent of total project emissions.

Second, in direct contradiction of the Paris agreements used to justify the exclusion of Scope 3 emissions, the proponents argue that damage from greenhouse gas emissions that takes place outside NSW (including, for example, damage to the Great Barrier Reef) should be disregarded. Since NSW accounts for approximately 0.1 per cent of world population, the analysis disregards 99.9 per cent of Scope 1 and 2 emissions, as well as all Scope 3 emissions.

A less significant, though still notable, source of understatement is the use of the tender price under the Emissions Reduction Fund (ERF), around $A13/tonne of CO_2, as a measure of the cost of environmental damage arising from greenhouse gas emissions. The cost of the ERF represents a statement of the Federal government's willingness to pay for claimed emissions reductions, given a tight funding constraint. It bears no relation to the cost of damage. A more appropriate standard would be the social cost of carbon used in US benefit cost analysis set at $US37/tonne (approximately $A50/tonne) under the Obama Administration https://obamawhitehouse.archives.gov/blog/2013/11/01/refining-estimates-social-cost-carbon

The cumulative effect of these inconsistent and extreme choices is that the cost of greenhouse gas emissions over the entire life of the project is estimated at $100 000, or around $5 000 per year of the project life.

To provide some perspective on this, Australia's emissions currently amount to around 20 tonnes per person per year, or 100 tonnes per year for a (mythical average) family of 5. At a carbon price of $50 per tonne the greenhouse gas damage cost for such a family would be $5 000 per year, equal to that presented in this document as the cost of damage associated with a massive coal mine.

Using a carbon price of $A50/tonne and taking all emissions into account, the present value of climate change costs associated with the project is of the order of $A4 billion, which exceeds the total benefits, including benefits accruing outside NSW.

Professor John Quiggin

School of Economics, University of Queensland

17 September 2019

APPENDIX B: STATEMENT BY DR IAN WRIGHT

Senior Lecturer in Natural Science, School of Science and Health, Western Sydney University.
https://www.westernsydney.edu.au/staff_profiles/uws_profiles/doctor_ian_wright

Review of Dendrobium Mine Extension Project EIS

Prepared by Dr Ian A. Wright

MSc (by research) Macquarie University
PhD Western Sydney University

I have prepared this report in conformance with the expert witness code of conduct, and I am willing to be bound by it (*Uniform Civil Procedure Rules 2005*).

I have been asked to produce an expert report that addresses the following questions:
We ask that your report address the following issues in regards to any impacts on the aquatic ecology arising from the Project:
(a) In your opinion, are the expected environmental impacts appropriately quantified?
(b) Provide any further observations or opinions which you consider to be relevant.

Are the expected environmental impacts in this EIS appropriately quantified?

The EIS Appendix E 'Aquatic Ecology Assessment' Executive Summary makes the following statement:

> *'The primary potential impact to aquatic ecology associated with the Project is the potential for mining-related subsidence and fracturing of bedrock in overlying watercourses. This has potential to result in diversion of flows, reduction in pool water levels and impact aquatic habitat, flora and fauna in the various watercourses traversing these area's'*

I agree with this statement, but one important aspect of the entire EIS Appendix E 'Aquatic Ecology Assessment' that was inadequate, in my opinion, was the lack of information on water pollution that is likely to be caused by subsidence-induced fracturing of stream channel. Impaired water quality may also cause damage and impairment to aquatic ecosystems.

I regard water pollution triggered by long-wall mining and subsidence fracturing to be a major issue that has caused impairment of many Sydney basin aquatic ecosystems. In my opinion, water pollution of streams, wetlands and rivers is very likely to be caused by the proposed mining activity in the Dendrobium Mine Extension Project (Dendrobium). The flow disturbances that are also triggered by the fracturing also exposes unweathered sandstone to water, which mobilises a suite of chemicals including metals and minerals. Later in this submission I discuss this in more detail and also explain how my research has documented habitat damage, flow-disturbance and water contamination, all triggered by subsidence fracturing, cause impairment of stream aquatic ecosystems.

I base this opinion on several years of experience and associated peer-reviewed research that I have conducted on water pollution triggered by subsidence and channel fracturing from Tahmoor Colliery

on Redbank Creek from 2012 to 2017 (Wright et al. 2015; Morrison et al., 2018; Morrison et al., 2019). This is some of the only peer-reviewed water pollution research done on this topic in Australia. Although based in a different location, it is relevant to consideration of this mine as such independent research is impossible within the Sydney Water Catchment Special Areas which have highly restricted access that make such scientific studies very difficult.

I consider it to be inadequate that this EIS has not reported details and data on ecological impacts associated with previous similar coal mines in the region of the Dendrobium. There are many kilometres of mine subsidence impacts to surface waterways, and nothing in this EIS enables me to quantify the extent of the ecological impact that is likely.

Subsidence physical, chemical and biological damage to Redbank Creek

The subsidence-induced fracturing of Redbank Creek ranges from small hair-line fractures, to sections of creek channel that can be described as extensive and high-impact. See Picture 1, the section of creek below this subsidence only flowed after heavy rain, with smaller flows disappearing underground into the fractures.

Picture 1: Severe longwall induced subsidence fracturing of Redbank Creek, near Picton. This was upstream of the isolated pool (Picture 1).

Picture 1 shows a section of extreme subsidence fracturing. Whole slabs of sandstone have fractured and been lifted. The Dendrobium EIS predicts some occurrence of subsidence and damage to stream channels – damage similar to that observed in Redbank Creek (Picture 1) may potentially result. However, it may be hidden from public view as unauthorised public access to water catchment is prohibited.

Downstream of the Redbank Creek 'severe' fracture zone (Picture 1) were a series of isolated pools in low lying sections of the former creek channel (Picture 2). These pools had very poor water quality, with

very high salinity and very low dissolved oxygen levels. Whilst the Dendrobium EIS suggests that there may be some water quality impacts, the comments suggest that the impact would be minor and local. I disagree that the likely impact would be local and minor. I base this comment on my observations and research on Redbank Creek Picton, from 2012 to 2017. Given that such impacts from the proposed mining activity associated with the Dendrobium project could occur in a protected water catchment, I consider that any change to surface water quality to be unacceptable. I also consider that such water quality impacts to be likely could cause major negative ecological impacts, like that found in Redbank Creek (Wright et al., 2015).

Picture 2: An isolated pool on Redbank Creek, near Picton. This pool was stagnant, with minimal flow due to extensive channel fracturing and loss of flow. The mixture of stream water with sections of fracturing creek mobilised minerals and metals combined to create water quality that was hostile to stream flora and fauna.

Picture 3: Severe longwall induced subsidence fracturing of Redbank Creek, near Picton. This was the site of a ground water 'vent' where upwelling groundwater flowing into Redbank Creek, through a fresh subsidence fracture. Water quality very extremely poor for the aquatic ecosystem with very low dissolved

oxygen, very high salinity, and hazardous concentrations of metals such as zinc and nickel (Morrison et al. 2018; Morrison et al. 2019).

The pool in Picture 3 was an upwelling of ground water triggered by subsidence fracturing. The upwelling water had very low dissolved oxygen, almost certainly inadequate for the survival of any stream-dwelling animals. It also had highly elevated salinity and elevated zinc and nickel that together combined to created highly polluted water (Morrison et al. 2018; Morrison et al. 2019).

I consider it to be possible that such subsidence-triggered impacts and damage to stream channels, stream water quality and aquatic ecosystems, similar to Redbank Creek, could occur in the future to water catchment waterways due to the proposed Dendrobium mine project.

Subsidence fracturing damage to Redbank Creek provided habitat and condition for mosquitos

Picture 4: This pool in Redbank Creek was affected by subsidence and recorded a very high abundance of mosquito larvae and pupae. It also had very few 'normal' stream invertebrates.

See Picture 4. I sampled this isolated pool on Redbank Creek over more than two years and it provided a rich habitat for mosquitos. More sensitive typical stream invertebrates were missing due to the highly impaired water quality. This pool had depleted dissolved oxygen, very high salinity and elevated zinc and nickel (Wright et al. 2015). This physical subsidence damage to the creek channel, the impaired water quality and adverse impacts to the aquatic ecosystem have all occurred over many years in Redbank Creek. The transformation of a healthy stream ecosystem into one that supports a domination by mosquitos is unusual and is a potential ecological impact. It also has potential human health implications, if the mosquito species are disease vectors.

I am uncertain how quickly and effectively such damage to streams can be achieved. The damage to Redbank Creek was covered by ABC TV (https://www.abc.net.au/news/2018-09-17/sydney-coal-mine-ordered-to-repair-cracked-creek/10253148). That report quoted the NSW Government and claimed that the creek damage would be repaired by the miner. I have never seen major subsidence damage to a creek or river channel repaired. I have personally observed repairs to minor channel fracturing in the Georges River, and have observed that repairs are unable to fully repair the damage.

In my opinion the EIS needs to provide more information on exactly how minor, moderate and severe damage to stream and river channels is to be repaired.

The Dendrobium EIS makes this statement in the Appendix E Conclusion:

> '*Based on previous experience, and dependant on the extent and magnitude of any mining related impacts, the abundance of these components of aquatic ecology in the local and regional area would suggest that any impacts would be relatively minor in the context of the wider catchment area*.'

I disagree with this statement. I think that it is likely that the Dendrobium project could cause substantial physical, chemical and ecological damage to surface waterways. Such damage could resemble that at Redbank Creek, in the Upper Nepean area. The damage to Redbank Creek is severe, has long term impacts, and no rehabilitation has yet been attempted. In my opinion such damage, similar to that experienced at Redbank Creek, is major, is possible with the Dendrobium project. I consider such damage of this nature in a protected water catchment to be an unacceptable risk.

Poor methodology for assessment of stream macroinvertebrates using AUSRIVAS

The EIS Appendix E 'Aquatic Ecology Assessment' Executive Summary also makes the following statement:

> '*Overall, the AUSRIVAS macroinvertebrate assemblages sampled in the current study are comparable with those sampled from across the Dendrobium Mine area during previous studies by Cardno. While AUSRIVAS results suggest somewhat impaired (i.e. contain fewer taxa than expected based on the creek's physical and chemical characteristics) macroinvertebrate assemblages, there is no evidence this is related to any anthropogenic disturbance. Rather, this appears a natural occurrence reflective of naturally low values of pH and possibly also dissolved metals associated with local geology'.*

I strongly disagree with this statement. Firstly, I consider AUSRIVAS assessment of stream macroinvertebrates to be a poor choice of methods for detection and measurement of ecological

impairment. AUSRIVAS uses a comparison to modelled reference sites. In my opinion macroinvertebrate sampling should use multiple spatial replicates, and compare local reference sites to mining affected sites. We used this approach in our study of macroinvertebrates in Redbank Creek, which detected major differences in the subsidence-affected area compared to the unaffected upstream reference site (Wright et al. 2015).

Secondly, naturally vegetated streams of the Sydney basin generally have low pH and high metals (aluminium, iron and manganese) (see Belmer and Wright, 2019). However, coal mine subsidence changes the metals in stream water and can result in elevation of aluminium, iron, manganese, cobalt, barium, lithium, strontium, zinc, nickel (Wright et al. 2015; Morrison et al. 2018 and Morrison et al. 2019).

Loss of habitat for the endangered Giant Dragonfly (*Petalura gigantea*)

The EIS Appendix E 'Aquatic Ecology Assessment' Executive Summary also makes the following statement:

> *'Giant Dragonfly (Petalura gigantea), listed as Endangered under the BC Act, potential foraging and / or potential breeding habitat was identified in several swamps in the Study Area. The relatively large number (> 30) of dragonfly larvae burrows identified in Area 6 Swamp Den83 potentially indicates the swamp provides particularly important breeding habitat for this species'.*

I regard this statement as accurate, and given that many swamps are likely to be damaged by the proposed Dendribium mining activity, this indicates that loss of Giant Dragonfly (*Petalura gigantea*) habitat is likely. I expect that many of the wetlands above the proposed Dendrobium mining activity to be damaged and lose habitat for may species, including the Giant Dragonfly.

Future remediation of subsidence damage to stream channels

The EIS Appendix E 'Aquatic Ecology Assessment' Executive Summary also makes the following concluding statement:

> *'CONCLUSION Implementation of the aquatic ecology monitoring recommended in this AEA would assist in determining the magnitude and extent of impacts to aquatic ecology associated with extraction of the proposed longwalls. The detection of physical impacts, such as rockbar fractures resulting in water loss in a pool within Donalds Castle Creek or third order or higher drainage lines or significant changes in water chemistry within such areas, should trigger further investigation into potential impacts on aquatic ecology. The implementation of such management measures would help reduce potential impacts on aquatic ecology. As no significant impacts to threatened aquatic ecology species, populations or communities listed under the FM Act or EPBC Act are predicted, no associated biodiversity offsets would be required. The requirement for and form of any offsets*

associated with significant impacts to Key Fish Habitat in third order and higher watercourses identified during monitoring, would be identified following the completion of any required stream remediation activities'.

In my opinion, once such impacts to stream and river channels are detected, I am not aware of how such damage would be repaired. Given the lack of such information, I am not convinced that damaged streams can actually be repaired.

Water Quality Impacts caused by subsidence fracturing

The EIS Appendix E 'Aquatic Ecology Assessment' Executive Summary also makes the following concluding statement (Section 3.4 Water Quality).

'3.4 Water Quality Previous surveys have indicated that some measures of water quality within Donalds Castle Creek have often been outside of ANZECC/ARMCANZ (2000) guidelines. However, the relatively remote and undisturbed catchment area does not suggest influence by any anthropogenic disturbance. EC measurements taken during the baseline aquatic ecology monitoring for DA3B (Cardno Ecology Lab 2012a) and during recent ongoing monitoring (Cardno Ecology Lab 2015) showed levels were generally within the ANZECC/ARMCANZ (2000) default trigger values (DTVs) (30 to 350 micro Siemen per centimetre [µS/cm]) for upland rivers in south-east Australia. The exception was at one site (Site X1), where the level occasionally fell below the lower guideline value. The pH of the water at monitoring sites was always below the lower (pH 6.5) DTV. Low pH levels have been recorded generally across the Dendrobium Mine area, and appear to occur naturally, most likely associated with local geology and its influence on water chemistry. DO levels at one site (Site X1) were either within DTVs (90 to 110 % saturation) or sometimes below the lower DTV. DO measurements at another site (Site 14) were more variable, ranging above and below the DTVs. The turbidity measurements were within, or below, the guidelines (2 to 25 NTU [Turbidity]). NTU values below 2 are not cause for concern, and most likely reflect the relatively low organic content of the water'.

I find this statement to be highly unusual. Natural streams draining undisturbed and naturally vegetated catchments in the Sydney basin often have very low conductivity. For example, reference stream sites upstream or unaffected by mining in the upper Wollangambe River area had a conductivity of 15-36 micro-Siemens per cm (Wright et al. 2017). Similarly, pH levels in natural streams also often falls below a pH of 6.5, with reference streams in the upper Wollangambe having a pH ranging from 4.9 to 6.3 pH units. The ANZECC (2000) broad guidelines are for South Eastern Australia. Local or regional-specific guidelines are needed for reference sites, as recommended by the ANZECC (2000) guidelines, using the 20th percentile for most water quality attributes (with some exceptions, such as dissolved oxygen).

The water quality EIS chapters also contain inadequate information on likely water quality impacts. The following statement is made in one of the water quality chapters (26 A Appendix C):

> *'Potential impacts on water quality as a result of the Project subsidence impacts would be localised (e.g. localised changes in water quality in the Avon and Cordeaux Rivers and their tributaries). Although mine subsidence effects can result in isolated, episodic pulses in iron, manganese, aluminium and electrical conductivity, these pulses have not had a measurable effect on water quality in reservoirs downstream of mine induced subsidence areas within the Southern Coalfield. These pulses have also been observed in surface water catchments within the region which are located outside of the zone of influence of mining activities'.*

My research on Redbank Creek has revealed consistent (over multiple years) poor water quality in subsidence-affected reaches. Rather than 'isolated and episodic pulses' I recorded consistent elevated iron, manganese, aluminium, nickel, zinc, barium, lithium, strontium, cobalt and salinity (Wright et al. 2015; Morrison et al., 2018; Morrison et al. 2019). In addition, I found that impaired water quality in such localities had impaired ecosystems (Wright et al. 2015).

Damage to Illawarra Coastal Upland Swamps

One of the key environmental impacts that is predicted in the EIS is the likely permanent damage to the high conservation-value 'coastal upland swamps' that are found above the two new mining areas (area 5 and area 6).

I consider this to be of considerable concern. Coastal upland swamps are threatened ecological communities that are protected by NSW and Commonwealth legislation. They are very fragile and are highly vulnerable to changes in groundwater. Mining has been associated with historic and permanent damage to these wetlands.

I am concerned that 'drying out' and 'lowering of water tables' in the vicinity of these wetlands to underscore the probably permanent damage. Once these swamps are dried out, the 'peat' that the swamps accumulate and grow in, is then exposed to erosion and is particularly vulnerable to damage from bushfires. The damage from bushfires is much worse after swamps dry out (this happened in devastating 2001 bushfires in the surrounding water catchment).

References

ANZECC (Australian and New Zealand Environment and Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). (2000). *Australian and New Zealand guidelines for fresh and marine waters. National Water Quality Management Strategy Paper No. 4.* Australian and New Zealand Environment and Conservation Council/ Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Belmer and Wright IA (2019) The regulation and impact of eight Australian coal mine waste-water discharges on downstream river water quality: a regional comparison of active versus closed mines. *Water and Environment Journal*

Morrison KG, Reynolds JK and Wright IA (2019) Subsidence fracturing of stream channel from longwall coal mining causing upwelling saline groundwater and metal-enriched contamination of surface waterway *Water Air Soil Pollution*

Morrison KG, Reynolds JK, and Wright IA, (2018), Underground coal mining and subsidence, channel fracturing and water pollution : a five-year investigation, Australian Stream Management Conference, pp 689-696,

Price P, and Wright, I.A. (2016) Water quality impact from the discharge of coal mine wastes to receiving streams: comparison of impacts from an active mine with a closed mine, submitted to *Water, Air, and Soil Pollution*, vol 226, no 10

Wright IA, McCarthy B, Belmer N, Price P, (2015) Subsidence from an underground coal mine and mine wastewater discharge causing water pollution and degradation of aquatic ecosystems, *Water, Air, and Soil Pollution*, vol 226, no 10

Wright I, Belmer N, Davies P, (2017), Coal mine water pollution and ecological impairment of one of Australia's most 'protected' high conservation-value rivers, *Water, Air, and Soil Pollution*, vol 228, no 3

Qualifications and experience

I am an environmental and water scientist with more than 25 years of experience investigating the impact of human activities on waterways of the Sydney basin. I am currently employed as a Senior Lecturer in the School of Science and Health at Western Sydney University. Earlier in my career I was a freshwater scientist, working in various roles at Sydney Water. This included working as a scientific officer in Sydney Water's scientific laboratories at West Ryde. I then worked as catchment officer in Sydney Water's drinking water catchments. After received my PhD, I was awarded a Postdoctoral Research Fellowship in freshwater ecology and water pollution research at Western Sydney University. Before becoming a fulltime lecturer in 2012, I established a consulting business, mainly helping local Government with projects associated with urban water quality and ecology. I am an advocate for sustainable water and catchment management and I strongly support multi-disciplinary projects. I seek to manage industry problems with evidence-based science. I have specialist scientific expertise in freshwater ecology, water chemistry, pollution ecology of waters, freshwater macroinvertebrates as pollution indicators, impact of urban development, sewage effluent, agricultural, and mine waste impacts on streams and rivers. I have expertise in the sampling design of environmental science studies and statistical analysis of environmental data. I have published (as senior or junior co-author) more than 70 peer-reviewed publications. I have provided independent expert testimonies for environmental science matters for the NSW Land & Environment Court. I am an enthusiastic participant in community engagement activities in my field of expertise.

Qualifications

2006. Doctor of Philosophy, University of Western Sydney.

1995. Master of Science (by research), Macquarie University.

1988. Bachelor of Applied Science (Agriculture), Hawkesbury Agricultural College.