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TRANSCRIPT OF PROCEEDINGS

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INDEPENDENT PLANNING COMMISSION

PUBLIC HEARING

RE: DENDROBIUM MINE EXTENSION PROJECT

COMMISSION:	**STEVE O'CONNOR (CHAIR)** **JOHN HANN**
COUNSEL ASSISTING:	**RICHARD BEASLEY SC**
LOCATION:	**THIS PUBLIC HEARING WAS CONDUCTED BY VIDEO AND WAS BROADCAST LIVE ON www.ipcn.nsw.gov.au/livestream AND 1800 093 431**
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MR O'CONNOR: Good morning and welcome to day 3. The final day of the Independent Planning Commission's electronic public hearing into the state significant development application for the Dendrobium Mine extension project. I'm Steve O'Connor and I am Chair of the panel. Joining me is Deputy Chair of the Commission and my fellow Commissioner, John Hann, on my left. We also have Richard Beasley SC and counsel assisting the commission at this public hearing on my right.

Before we begin I would like to acknowledge the traditional custodians of the lands on which we variously meet, and pay my respects to their elders past, present and emerging and to the elders from other communities who may be participating today. This state significant development application has been lodged by Illawarra Coal Holdings Proprietary Limited, a subsidiary of South32, the applicant. South32 owns and operates the Dendrobium mine, an underground coal mine located eight kilometres west of Wollongong.

The mine produces metallurgical coal for steelmaking in Australia and overseas. South32 is seeking planning approval to extend the current mine operations to allow the extraction of an additional 78 million tonnes of run-of-mine coal from two new mining areas identified as area 5 and area 6. The proposal is also seeking to extend the life of the mine from 2030 – that's the current time it will lapse – to December 2048. The application has come to the Commission for determination because it received more than 50 unique public objections.

I note the Department of Planning, Industry and Environment, in its assessment report, has recommended approval for the project. The Minister for Planning and Public Spaces has directed the commission to hold a public hearing into the application. He has asked the commission to determine the application within 12 weeks of receiving the final whole-of-government assessment report from the department. In line with regulations introduced in response to the ongoing COVID-19 pandemic we have moved this public hearing online with registered speakers providing the – provided the opportunity to present to the panel via either telephone or video conference.

In the interests of openness and transparency we are livestreaming proceedings on the Commission's website. A full transcript of day 3 of the hearing will be published on the website in the next few days. We have many speakers on today's schedule. As such I would ask everyone presenting today to please keep to your allocated speaking time. As Chair I will enforce timekeeping rules to ensure everyone receives a fair share of time. However, I do reserve the right to allow extra time for the panel or counsel assisting to ask questions or to hear new information.

I would encourage presenters to avoid repeating or restating submissions previously made on this application noting that will be particularly assisted by hearing your views on the department's assessment report and the recommended conditions of consent. Thank you. It's now time to call our first speaker.

MR BEASLEY: Our first speaker this morning is Bronwyn Evans. Ms Evans, are you there?

MS EVANS: Yes.

MR BEASLEY: Thank you. Please go ahead.

MS EVANS: As a practicing veterinarian I focus mainly on animal life and the ecological systems and habitats which support them. Each element of the environment, both living and material, is intricately connected and interdependent. No element can survive alone. An effect on any affects the other elements. This extends from the microscopic aquatic stygofauna, the pollinating insects to the species we notice and love, such as koalas. For the purpose of this five minute presentation I will use the koala, not only because it is iconic, but also as there is such a lot of recent research and public awareness of this species' vulnerability.

Having read the environmental impact statement by Niche for the multinational South32 many times it's so much information, charts and data I almost started to become convinced they were getting it right. Then I focused in on my topic, the koala. Yes, lots of information, lots of charts, lots of data. But, looking carefully and logically, there are gaping holes and trails that lead nowhere. The bigger picture is lost. The overall conditions that they conclude will impact the koala is merely clearing impacts only. Within the areas to be cleared, which are not all yet defined. The survey finds only a few fig trees that are not of high quality. And, then, if he's in this area to be cleared, around the ventilation shaft where you would not expect to find any koala in the first place, the survey on koala population is carried out.

Unsurprisingly, after 10 hours of spotlighting, two and a half at each ventilation site, looking one kilometre up a track from the ventilation site and mine ..... service in area only five, they found one male herd, one and a half kilometres off. The survey company itself says only a limited survey was carried out in subsidence areas as koalas were not likely to be impacted. It sounds a little bit like Donald Trump decreasing his testing to stop finding the increase in COVID numbers. The survey was also carried out during the non-breeding season when all koalas are on the move, both male and female. The core breeding area not tested, or quantified, is only 300 metres north of a ventilation site. This detail is exempt from acknowledgement or impact in the – sort of in the impact statement.

To detect koalas from becoming roadkill, the environmental impact statement says it will set a speed limit of 40 kilometres an hour. On mainland service and beautiful roads around schools in Sydney, the speed is limited to 40 kilometres. I can hardly see that individuals with barely their mind on koala safety driving four-wheel drives over unsealed roads, would be an adequate minimum – maximum speed of 40 kilometres. It's hardly equivalent. And, then, if we do have a koala that's injured, yes, there's a plan that they will contact carers and veterinarians. But what is the time to get this koala, or injured – any injured wildlife to a place of care? They want to monitor these animals.

Yes, they should be monitored. But they should be monitored within a veterinary facility that can take care of them. As a veterinarian, having taken care of many injured wildlife, I can tell you that they are fairly well dead by the time an interested person picks them up of the road. And it is usually the overworked, understaffed, not paid and not funded charities, such as WIRES. There seems to be no plan within this EIS to supplement the support of these groups, if they do have to take care of the animals. Also, how will these groups be able to access the animals when they are being hit within a special area they have no access to. It would be unacceptable for profit-making company to not acknowledge the work of these charities. In June 2020, five months ago, the New South Wales Parliament received the report from the inquiry into koala populations and habitat in New South Wales. Many recommendations were given. Relevant to this project - - -

MR O'CONNOR: You'll need to wrap up now, please.

MS EVANS: So I was going to discuss some of the relevant recommendations from the koala habitat review, but that will have to be in my written report. To summarise, I would just like to say that the primary purpose of a special area, this special area, that was enabled in 1880, is to supply drinking walking. To allow this mine to proceed, makes a mockery of this special area, and puts at risk all of the habitat within the special area; its purpose. Thank you.

MR O'CONNOR: Thank you, Bronwen. And by all means, please follow up those additional points you wanted to make in a written submission. That would be much appreciated. I'll just see if there's any questions.

MR BEASLEY: Not from me. No.

MR O'CONNOR: No questions. Thank you very much.

MR BEASLEY: Our next speaker is Lauren Sims, who's instructed by the Environmental Defenders Office, who are acting on behalf of Protect Our Water Alliance. Ms Sims.

UNIDENTIFIED FEMALE: Look, the main point really, is that you can't just - - -

MS SIMS: Thank you, Mr Beasley. Good morning Commissioners. As Mr Beasley said, I'm briefed by the EDO on – to make submissions on behalf of Protect Our Water Alliance. Our fundamental submission is that this project doesn't stack up when you balance the environmental impacts with the economic benefits. That is, the impacts of this project are unacceptable and are not justified by the social and economic impact – benefits of the project. The EDOs arranged a number of speakers who will give expert evidence about the environmental impacts of the proposal, including the economic consequences to the drinking water supply and to climate change. They will also provide information about economically viable alternatives to the project that don't have the associated environmental and economic costs.

Further, the evidence will raise the question of the appropriateness of using offsets to balance out those environmental impacts when the impacts have not been properly been quantified or justified under the avoid, mitigate, and offset hierarchy. My submissions will focus on the application of the principles of a environmentally sustainable development to the project, and I will also address the Sydney drinking water catchment, SEPP, and how that should be applied and interpreted. So starting with ESD, the overarching principle of ESD is the effective integration of environmental social and economic considerations in the decision-making process.

Firstly, I would like to note in the assessment report, the Department of Planning considers that it's relevant to consider the downstream economic impacts of – of the project, that is, the use of the coal produced in the BlueScope Steel at Port Kembla, and other downstream economic impacts. But they ask us to ignore the impact of the scope 3 greenhouse gas emissions that – that will inevitably occur if – when those economic benefit are realised at the BlueScope Steel site. So we're not comparing apples with apples. It's important to factor all of the environmental and economic impacts, if you're going to go to the downstream impacts.

Secondly, in terms of the balancing exercise that the Commission will have to do in terms of balancing the environmental impacts versus the economic and social benefits, is to consider whether – where that – if – if that balance is reached, having regard to alternatives to the project, that would achieve the same or similar economic benefits without incurring the environmental impacts. The consideration of alternatives in the assessment report and the EIS is very limited. The main consideration is how the mine – the – the – the mine can be designed to avoid or minimise the impact, but only in the context of changing the longwall panel layout, or width, rather than considering another mining method.

So the – there is a detailed consideration of narrowing the longwall panels, and they say, well, this wouldn't reduce the environmental impact. They reach a conclusion that says that, therefore, narrowing the longwall panels is not economically justified. Well, we submit that the opposite is the case. What that proves is that there's no – there's no way to use longwall mining methods for this mine that avoids those impacts. There is a superficial consideration of shortening the longer – the longwall panels to not directly undermine the swamps. That's described as a minimum case. The result of that is – is said to lose 21.2 megatonnes of coal out of a total resource of 77.2 megatonnes, which is worth about $3 billion in the context of a $10 billion resource.

And the proponent says that it's not economically, um, feasible and that it would still have the surface water impact. So that's ruled out as an alternative. They also considered mining other areas within the resource. Area 4 would have worse impacts on swamps, and Area 3C is too gassy to mine right now and needs to be drained. So what this demonstrates is that there's no economic way of using longwall mining that avoids the unacceptable environmental impacts of this project.

There was no consideration in the assessment report of alternative mining methods. For example, bord-and-pillar mining. There is a cursory statement in the EIS at section 9.2.1 about bord-and-pillar mining. They refer to the Southern Coalfields inquiry report that says that, generally, bord-and-pillar mining is not viable for new projects in Australia. However, what hasn't been done is to assess it specifically for this project, given that it is actually an existing mine project. The infrastructure costs have already been expended. There was already pit top facilities and what have you, a rail connection.

So that assessment of whether bord-and-pillar mining would stack up for this project hasn't been done. So – but bord-and-pillar mining, nevertheless, is ruled out as being not economically viable. So, again, if there's no economic way of mining this resource without incurring the unacceptable environmental impacts, this resource should not be mined. The economics is the reason why other alternatives to coal mining at all, for example, green steel, are ruled out, but those – what hasn't been done is compared the economics of those green steels with – green steel options with the economics of a coal mine that avoids the environmental impacts.

So we're not comparing the same playing field for those. The other option alternative to this mine is to mine somewhere else. This mine has a relatively high scope 1 and scope 2 greenhouse gas emissions because it's a gassy line. It also has those high environmental impacts because it is beneath the streams, and, particularly, the Uplands Swamps. There are – there is enough coal in New South Wales to mine for as long as mining will be permitted in New South Wales. This – the coal can be won elsewhere that wouldn't have the same environmental impacts, or don't mine at all. The experts that will be speaking on behalf of the EDO will address the issue of the economics of green steel.

In terms of the precautionary principle, the response in the assessment report to scientific uncertainty about the impacts is to say, well, the proponent has committed to offsetting. That's not appropriate because the full environmental impact of these – of this mine hasn't been determined and it is not known. It is not – it's not enough to say, well, if the impacts are exceeded, we will pay for more offsets. That is not a precautionary approach. The experts today will speak to you about some of those risks of serious harm, and I would also like to just note that the conditions of approval set performance criteria. They don't actually set limits.

The consequence under the conditions of consent of exceeding those performance criteria is not that the mine has to stop. It is that rehabilitation, and if rehabilitation's not feasible, offsets. So it doesn't actually limit the impacts of this mine. What it does is provides for rehabilitation and offsets if those further impacts are incurred. The next principle of ESD is the conservation of biological diversity and ecological integrity, in particular, in regard to this development it applies in relation to Uplands Swamps. As a principle of ESD – the principle of ESD says that this should be a fundamental consideration in decision-making. The biodiversity offsets policy – the first – and in regard to Uplands Swamps, there's no proposal to avoid or mitigate the harm to those.

All that is proposed is that it would be offset. Principle 1 of the biodiversity offset policy for major development is before offsets are considered, impacts must first be avoided and unavoidable impacts minimised for mitigation measures. Only then should offsets be considered for the remaining impact. There was an addendum to that policy specifically addressing the impacts of Uplands Swamps by mining. That addendum says:

> *A proponent must seek to avoid longwall mining underneath Uplands Swamps and only used offsets where it can be demonstrated that all feasible measures to avoid and minimise impacts have been taken.*

Our submission is that that has not happened. It hasn't been demonstrated that all feasible measures to avoid the impacts have been taken. I turn to the Drinking Water at Catchment SEP. There's two propositions that need to be considered in that SEP. First is, is this a continuing mine for the purposes of that SEP? Sorry. Is it continuing development for the purposes of that SEP. There are several points to make about that. Firstly, one is the point in time at which you consider whether it's likely that the existing development will be subject to further applications. We think it's reasonable to say that that likelihood is at the time the original consent was granted. In this case, 2001. So the justification that the mining lease was granted and covers this additional area doesn't apply because the mining lease - - -

MR BEASLEY: Sorry. Can I just – sorry. Can I just ask you, Ms Sims. So in relation to 11(a)(2) of the SEP your submission is for the panel that when you consider whether the development was, "Likely to be the subject of future applications for extension or expansion", that you determine that at the time the original consent was granted.

MS SIMS: Yes. And in this case that was 2001.

MR BEASLEY: All right. Thanks.

MS SIMS: The mining lease - - -

MR BEASLEY: And that – is that – that's the question of fact for the panel to resolve.

MS SIMS: Yes.

MR BEASLEY: Yes.

MS SIMS: Yes. I agree that that's a question of fact that the – as a question of fact, the panel would have to be satisfied of that matter themselves, and that satisfaction needs to be on a sufficient evidentiary basis.

MR BEASLEY: Yes.

MS SIMS: The only evidence that is relied on in the assessment report is the fact of the mining lease having been granted, and the department invites - - -

MR BEASLEY: I think that there might have been an additional factor in the evidence of – or the comments by Mr Young on Wednesday. I think you're right. I think in the assessment report what's relied on is that the mining lease area is bigger than the consent area, and I think what was additionally said, "Well, there was more coal to be won".

MS SIMS: Yes. And they ask the Commission to draw an inference from - - -

MR BEASLEY: Yes.

MS SIMS: - - - those two facts, and my submission is that that inference shouldn't be drawn because, as I said, the time when you determine whether future applications are likely is 2001 when the consent was granted. The coal – consolidated coal lease is - - -

MR BEASLEY: Absent some express statement of an intent to seek an extension or expansion, you're right, aren't you? It has – the panel has got to draw some inference based on whatever facts are available.

MS SIMS: Yes. Yes. That's right.

MR BEASLEY: Yes.

MS SIMS: The fact though that the mining lease was – covered a broader area, that one ..... was .....

MR BEASLEY: That happens in every mine, isn't it? There's - - -

MS SIMS: Yes. That's right.

MR BEASLEY: Yes.

MS SIMS: That's right. But the fact in this case is that coal lease was granted well before 2001.

MR BEASLEY: Right.

MS SIMS: So the fact that it covered a broader area wasn't really relevant to the point when we assess which is 2001.

MR BEASLEY: Yes.

MS SIMS: I wasn't able to actually find the specific date, but there is - - -

MR BEASLEY: Right.

MS SIMS: - - - a history of the mining.

MR BEASLEY: Okay.

MS SIMS: And it was a consolidation of previous leases. So perhaps at the time the titles were granted there was an intention to recover more of the resource, but in 2001 there – the mining lease isn't that relevant.

MR BEASLEY: Well, I guess - - -

MS SIMS: And then - - -

MR BEASLEY: - - - in 2001 when the consent was granted, the – at least as far as known facts are, the express intent is to only mine the project area, what's approved.

MS SIMS: Yes. And - - -

MR BEASLEY: Yes.

MS SIMS: - - - that mining would finish in 2030.

MR BEASLEY: Yes. Yes.

MS SIMS: The – the other point about that is that this – the mining hasn't actually finished under the current - - -

MR BEASLEY: Yes.

MS SIMS: - - - mine – current development consent. I'll turn to the – just looking at the time – I'll turn to the modified NorBE test - - -

MR BEASLEY: Yes.

MS SIMS: - - - that's been that cause. So the background - - -

MR BEASLEY: This is – this is straight out statutory construction, right?

MS SIMS: Yes, it is. The background to this amendment – the amendment that introduced this part for the SEPP – is the – is a little bit unusual for a SEPP in that it was – it was done by way of legislation through Parliament rather than through the normal SEPP – the environmental planning instrument process of delegated legislation. And the history is that the Court of Appeal had made a decision about how the – the normal NorBE test, if I can call it that, ought to have been applied for the Springvale mine. And – and with that context in mind there are two, sort of, things to consider that will assist us to interpret the SEPP.

First is comparing with the case of the Springvale mine. In that case the mine had a discharge of – of saline water into a creek. If the consent ceased when it – if mining – if mining ceased when the consent ceased that water discharge would also cease. And – but because mining was continued that same discharge would continue. It wasn't – it wasn't an increase to the discharge.

MR BEASLEY: No.

MS SIMS: It was the same discharge. So – and then the second point is – is – I wanted to take the Commission to just an extract from the second reading speech because, as I said, it went through Parliament. So the second reading speech relevantly says:

> *The bill clarifies how the water quality test is to be undertaken for this type of development by amending the existing SEPP for the drinking water catchment. For continuing development the basis of determining the effect on water quality should be the new development. That is the extended or expanded part of the proposal and not the development that is already authorised by then existing approval even if it is time limited. The existing impact for part of the current water quality levels that will need to be compared –*

And then just reading – skipping ahead:

> *Importantly, nothing in the bill will result in a reduction in the level of water quality currently required by the planning legislation or development consents. Development in the Sydney drinking water catchment will still need to have a neutral or beneficial impact on water quality in order to be approved.*

So we say that that background is relevant to interpreting the test that is set out in the SEPP. We say that the – the SEPP requires – it does refer to the – the existing conditions of consent - - -

MR BEASLEY: Yes.

MS SIMS: - - - but it requires a comparison if the existing – if the existing impacts under the existing consent were to continue versus the – assume that those impacts continue but compare it to the case where the mine now is expanded. So that – that involves going beyond the comparison of just the conditions of the consent. In this case the impacts of the existing mine, in fact, will continue. The cracking in the – the stream beds continues to cause water to – to go into the – the ground and then come out again polluted with heavy metals. And now, as proposed, further cracking will occur. So it's actually increasing and having that same consequence of the heavy metals being introduced into the water resource.

So there is actually an increased impact as compared with just continuing the impacts of the existing mine. And we also say, in any event, even if it comparison between the conditions of the existing approval and the conditions of the new approval – we

say, in any event, that the test is not satisfied because the new conditions don't place the same limit on impact as the current conditions. The current condition says that the development must ensure the development that not does – does not result in reduction other than a negligent – negligible reduction in the quality or quantity of surface water or ground water inflows. The proposed conditions don't actually limit the impact of the development. What they do is they set a performance measure which is a negligible reduction in quality, but it doesn't limit it. It says in the event that that performance measure is exceeded additional rehabilitation and offsetting is required. So it actually doesn't cap the limit – cap the impact. And then, finally, I would also like to just make this submission in relation for the application of the SEPP to the project. Even if that test is satisfied in this case that is not the end of the assessment. The SEPP doesn't set up a non-discretionary development standard which is – some of things in the – in the mining sector. So in clause 12AB of the mining SEPP there are certain standards, for instance relating to noise - - -

MR BEASLEY: Yes.

MS SIMS: - - - that if those are met then that's not a basis on which consent can be refused. This isn't that scenario. The impacts on water quality – even if – assuming the NorBE test is just a gate to - - -

MR BEASLEY: Yes.

MS SIMS: - - - that – to get through then the water quality impacts are still a relevant for consideration in the overall assessment of the project.

MR BEASLEY: Yes.

MS SIMS: That's – sorry, I've gone overtime, but that was – that was the end of what I had to say.

MR BEASLEY: All right. Can I just ask you something? You said earlier on in relation to the longwall mining. I understand what you said about the longwall mining is not appropriate here because that's clear from the fact that you get – it seems as though you get the same environmental impacts regardless, pretty much, of the width of the longwalls, but I assume your submission is not that – I mean, that is – that is the proposal before the panel. For a longwall project. The panel can't guess what the impacts or benefits might be if it was a bord-and-pillar proposal, correct?

MS SIMS: Yes. That's right.

MR BEASLEY: Yes.

MS SIMS: And – and that's why the absence of assessment is important.

MR BEASLEY: Right. And just so I understand – no doubt you'll be putting in something in writing, but on ESD, in particular the precautionary principle, do I

understand your submission to be this. That one, first of all, there clearly are, without doubt, risks of environmental impact, risk of environmental – serious environmental harm in relation to water risks, biodiversity risks and there are also, undoubtedly, going to be some likely benefits of the project. Your submission is that the proportionate response in weighing up the – the threats of the damage versus the probable benefits are that the proportionate response here is – is to refuse consent.

MS SIMS: Yes. That's our submission.

MR BEASLEY: Yes. All right.

MR O'CONNOR: I've just got a question. I know you had limited time to – to make your presentation and you focused on the ESD principles. I'd just like to know. Are – and this might – might come in further submissions you might choose to make, but are there any particular objectives of the Act that you think we should particularly focus on. Obviously, ESD is references and objective of the Act, but any others?

MS SIMS: I – I haven't – I haven't identified any others that are – that are particularly relevant, but it's the public interest which incorporates ESD.

MR O'CONNOR: Okay. Thank you. John, do you have any questions?

MR HANN: No.

MR O'CONNOR: Any further questions?

MR BEASLEY: Not – not from me. Nothing further, thanks.

MR O'CONNOR: Thank you for your time, Lauren. Thank you. The next speaker is Peter Dupen, who has also been briefed by the EDA on behalf of the POWA. Mr Dupen.

MR DUPEN: Good morning, commissioners. I'd like to pay my respect to the Gandangara people from whose ancestral and unseeded land I speak from. I respectfully submit to the commissioners that they should reject this proposal on the grounds that it is not ready for a final determination. Key information has not been provided to enable the commissioners to make a sound and properly informed decision. My name is Peter Dupen. My qualifications to provide this advice include that I am a senior hydrogeologist now researching methods of improving environmental impact and decision making with better analytical approaches and engagement in a PhD supported, in part, by DPIE.

I have over 30 years experience as an environmental regulator and consultant, importantly including five years as the mining manager for WaterNSW up until 2019. During this period my team and I examined underground mining, particularly Dendrobium mine, impacts on catchments in greater depth than anyone else in

Australia. I have been instructed by the EDO on behalf of the Protect Our Water Alliance to provide independent and professional advice as an expert witness and not to advocate for or against the proposal. I take this instruction seriously and have considered the proposal in depth, and my professional advice is that this proposal should not be in front of the commissioners without key information gaps identified by the IEPMC having been addressed. Not all of these unfulfilled recommendations are dealbreakers, but there are three that, in my opinion, really are.

So just to give some context where that conclusion comes from, the government represented by DPIE received final reports from the IEPMC in October 2019. These reports contained a range of observations about the unanticipated extent of impacts that are now understood are Dendrobium and Metropolitan Mines, and made 50 recommendations. Minister Stokes commendably responded on behalf of the New South Wales government in April this year to say that we've accepted all of the recommendations from the panel and have established an interagency taskforce to implement a detailed action plan throughout this year. Eight months later the government has formed the Independent Advisory Panel for underground mining using questionable selection practices, but appears to have stalled on all of the other recommendations made by the panel.

In my opinion, DPIE should not have progressed this proposal until the most central issues identified by the panel have been answered, as Minister Stokes suggested they would. The key questions that I suggest are essential here is: (1) what is government's definition of an unacceptable volumetric loss from Sydney's water supply due to mining; (2) if the precautionary principle is to be applied, how narrow do the longwalls need to be in order to maintain 200 vertical metres of unfractured rock between the upper and lower fracture zones and; (3) what is an appropriate level of compensation, given the likely permanence of the existing and future catchment losses, and how can it possibly be as low as currently being proposed.

The answer to all of these questions are available and/or could and should have been determined in a transparent and credible manner before DPIE passed the ball to IPC for final determination. It is disturbingly clear from the submissions today, from the company and key agencies, that these data gaps are not being addressed by the government or, if they are, then it is being done behind large, locked doors.

Further, key information is inexplicably not being made available to the commissioners to help them make this critically important and momentous decision. I used the reminder of my time to explain why I view these as fundamentally important questions and to offer some advice about how they could have been readily addressed by now. So the first issue is about the water supply impacts exceeding predictions and yet remaining negligible. So Dendrobium's experts promised in their 2000 EIS essentially that we'll take the coal, you'll keep your water. The planning approval consequently awarded included a condition that Dendrobium have a no more than negligible impact on Sydney's water supply.

The past five years has been tumultuous in advancing our understanding of mining impact in the special area catchments. Beginning with the detailed evidence provided by Peter Turner to Minister Stokes, and the minister's brave decision to require further investigations, which led first to the PSM report in 2017 and subsequently to the formation of the IEPMC in 2018. Thanks to these and other workers, we now know the true extent of fracturing and consequent impacts on the special area catchments and storages. I understand that the commissioners are aware of these impacts, which have been discussed a great length over the past few days, and there's some more coming.

Although I remain concerned about all the impacts, I will focus this presentation on the volumetric losses from Sydney's drinking water supply. Following the past five years of intensive scrutiny by myself and others, current surface water loss estimates range from two to 6.5 gigalitres per year, increasing by yet another 3.5 gigalitres per year, if the Dendrobium extension is approved. To date, there have – there has never been a quantity of definition of negligible water losses, rendering DPIE's existing playing condition unenforceable. I note that no improvement is proposed in DPIE's draft conditions for areas 5 and 6. The most fundamental question for the commission is, in my opinion, how far can you stretch the term negligible impact in relation to Sydney's water supply?

Singing from a remarkably similar hymn book, South32, IEPMC and DPIE have, in the past, compared the estimated volumetric loses due to Dendrobium mine to evapotranspiration, retail pipe loss and other questionable metrics. I suggest that it's more meaningful to compare the volumetric losses with proportion of stored waters or with catchment flows in drought or with a financial impairment to using IPART values. For example, the total accumulative mining impacts on special area catchment volumes to date due to mining that – that have happened or are still going to happen amount to more than 450 gigalitres, using Paul Tammetta's volumetric conservation method, developed for but yet to be published by WaterNSW.

If this were – if this 450 gigalitres were to be removed at once from the catchments, this would empty all of the Undermined dams and all of the creeks. More specifically for Dendrobium, the mine is currently taking around five megalitres a day or 1.8 gigalitres a year from the special area catchments, almost none of which was predicted. Due to the extensive cracking and reduction in regional water tables, now strongly connected to the mine coal seams, most of the catchments, swamps and streams overlying the existing mine are now dry. Most of these surface water losses will be permanent.

The extension proposal would almost double the quantum of water loss and other impacts. Water New South Wales estimate that Dendrobium will be taking 10 of the 13 megalitres every day of surface water removed from special area catchments due to coal mining, and these are very conservative estimates. The commission has many worthy considerations in front of it. How are you to determine – how are you to balance the many commercial imperatives and difficult transitions if the extension is not approved against Sydney's super precious long-term water supply.

A key step in answering this question is to quantify what might reasonably be described as negligible, minor, moderate, major and severe impacts. The good news it that this has already been substantially completed, but as far as I can tell form the submissions to date, this information has not been provided to the commissioners. WaterNSW has spent close to $1 million developing the standardised assessment framework for mining in the special areas. This draft framework includes a set of impact severity thresholds, on which the mining companies and all irrelevant state agencies, including DPIE, have been consulted about mine specific and cumulative impacts in terms of water quantity, water quality and ecological consequences.

The IEPMC recommended in their final report that these thresholds should be finalised and published. I therefore find it surprising that the framework and thresholds have not been presented prior to or during this final assessment of whether the Dendrobium mine extension impacts may be considered acceptable. I strongly suggest that the draft framework needs to at least be presented to you for inclusion in your deliberations. It would be more appropriate, however, if the IEPMC's recommendations had have been enacted in a timely manner, and these thresholds were to have already been openly debated and some consensus found, at least within government, prior to such a pivotal decision being made about the future of Sydney's water supply.

I'm mindful I've only got about five minutes left. So I'll speak more quickly about the other two fundamental issues on which I feel the commissioners are not being sufficiently informed to make a sound decision. So the second issue is this issue of maintaining a constrained zone. Based on my experience of mining impacts on catchments, I support WaterNSW's recommendation that protecting the catchments requires that constrained zone of unfractured rock between the upper and lower fracture zones needs to be maintained. Given the uncertainties and ..... nature – nature of these two zones, however, I suggest that application of the precautionary principle requires an intention to maintain at least 200 vertical metres to reduce the depletion of surface waters to the loss rates being recorded at, say, the Metropolitan Mine.

The question then becomes how narrow would the longwalls need to be in order to maintain such a buffer. After first pooh-poohing it, the IEPMC have subsequently confirmed that the most reliable, currently available approximation for estimating the height of fracturing is the Tammetta equation from 2013. The panel, however, further suggested in their final report that this height should be more accurately estimated for each new mining domain based on post-mining investigation data, that this readily implemented recommendations to estimate Dendrobium height of cracking has not been progressed, despite numerous, expensive investigations to inform it.

It's perplexing and makes a commissioner's task harder than it needs to be. Again, I suggest the commissioners should refuse the past judgment on this proposal, until this important information gap is closed. The third question that I want to address here is the appropriate level of compensation for water supply losses due to mining.

There are a range of issues on which I question South32's proposals regarding the adequacy of compensation for the surface water it is planning to remove from Sydney's water supply. If I understand it correctly, no compensation is being proposed for the existing, unpredicted and currently unlicensed surface water take from Sydney's drinking water supply.

The volume of water likely to be removed from the supply by the proposed extension, variably estimated between 3.3 and 6 megalitres a day, is likely to be permanent due to the widespread development of surface to seam cracking and depressurisation of the regional aquifer. If we conservatively average three years in 10 to be drought years as climate change envelopes us, IPART rate values of $2.35 a kilolitre in normal wet years and $3.18 per kilolitre when the dam levels fall below 60 per cent, South32's predictions of 3.3 gigalitre a catchment – sorry. And South32's prediction of 3.3 gigalitres a year catchment losses.

We're looking at compensation rates of around $8.7 million a year. On this basis, the proposed full compensation of the extension losses of $103 million amounts to only 12 years of compensation, at which time the extension would be only half complete. Bear in mind when considering this compensation question that most of the existing mine will be continued to be pumped down to maintain access to areas 5 and 6, and that even when the pumps eventually stop, it is impossible for original surface and ground water conditions to return to pre-mining levels. I suggest that this issue needs much greater consideration before the commission accepts South32's meagre compensation proposal on behalf of the tax payers of New South Wales, and I am surprised by DPIE's ready acceptance and, indeed, encouragement of it in their submission.

In conclusion, despite the extraordinary volume of information and modelling presented in the EIS and subsequent fora, I suggest that there are three fundamental information gaps which constrain the IPC unnecessarily from making a sound and fully informed decision about this pivotal proposal. On this basis, I can only recommend that the proposal, in its current form, should be rejected. Thank you.

MR O'CONNOR: Thank you, Peter, for that presentation. Just a question around the calculation of the conversation, that last point that you raised. My understanding, and please correct me if I'm wrong here, is that the losses while mining is taking place, have been calculation. That the more difficult thing is to determine the losses likely post-mining. And I think the modelling has shown that losses might be sustained for up to 170 years post-mining. Those losses, presumably, diminish over that time, eventually go to nil, and I'm assuming that is the on the basis that the mine will be sealed. Is that the correct logic that you think has been applied, or needs to be applied?

MR DUPEN: There's a range of issues here. The idea of sealing the mine is – is kind of useful, in some ways, to reduce the amount of water that – that ultimately, you know, is going to want to push back, and will, actually, find its way out the escarpment, eventually, when groundwater levels do rise. So sealing is part of the

answer. But the – the fact that the actual strata have been so broadly now connected to the much more permeable coal seam, both the mined parts of it and the unmined parts of it, mean that there is essentially now a pipe to the drain at the bottom of the bath tub.

And so it's – as I've said, in my opinion, it's – it is pretty much impossible – it will never return to pre-mining levels, and – and it's a very big question whether it will even, you know, return close to pre-mining levels. There's a lot of different questions involved in that and I thank that the – the – I definitely believe that the modelling that has been done to date is very optimistic. I would say 170 years is – is optimistic to return something like pre-mining levels. And, as I say, I – I don't believe that it can ever actually return to full pre-mining levels. And with the cracks on the surface, and – and if the groundwater levels remained depressed, then we keep losing that surface water. I mean, depending where the groundwater levels obviously ultimately rise to. But it – it – it will never be the original.

MR O'CONNOR: Thank you for that response. John, do you have a question? No. Richard.

MR BEASLEY: Yes. Peter, you can feel free to take this question on notice. I assume you might send in something in writing to the Commissioners. But the independent advisory panel for underground mining did a report on this project in October this year, and the independent expert scientific committee did a report in August 2019, both of which, being as neutral as I can, raise some – raise concerns in relation to water concerning this project. Are there any matters of particular note that you think the Commissioners should have regard to in either of those reports? As I said, if you want to do – deal with that in a brief written submissions, that's fine. Otherwise, feel free to say something now as well.

MR DUPEN: Yes. Just quickly. The estimates of loss that have been projected, you know, started the – only – only six years ago, the mining company was projecting incredibly low losses, and due to all this new information, which has come from ..... we can now see that the losses are much greater than they were saying six years ago. But I – you know, there – there is, of course, a range of estimates. The methodology that – that has been used particularly by Col Mackie from IEPMC is – is very good. But it is all about looking at the response of mine inflows to rainfall and looking at that relationship that completely ignores all of the other leakages from storages and – and the longer term losses that don't appear in the mine.

So there's a lot of questions which remain in play about the estimate of losses. But one of the things that I would say about this work that Paul Tammetta has done for Water New South Wales is that it does an outside envelope in what the losses will be and the rates will be. So it can be calculated pretty accurately but, to date, I don't believe that we've got a, you know, a totally accurate handle on those numbers. But they are certainly, you know, much, much better than they were six years. They're, you know, the amount of argument is much smaller now.

MR BEASLEY: All right, thank you. Thank you for your presentation, Peter. The next speaker is Dr Tanya Mason. Dr Mason.

DR MASON: Hello, good morning. I'm hoping to share my screen because I'd like to show a presentation, a PowerPoint presentation.

MR BEASLEY: Yes, that's come up now, you might just want to maximise it but - - -

DR MASON: Yes, just change those displays ..... is that okay?

MR BEASLEY: Yes, thank you.

DR MASON: Yes, okay. Okay, I've been looking at the effects of underground mining on the hydrology and community resilience of coastal upland swamps on the Woronora Plateau for a number of years. In a nutshell, along with my research collaborators, I've found very strong evidence that longwall mining is responsible for cumulative intergenerational loss of high value public ecosystem services provided by upland swamp.

These coastal upland swamps occur under specific hydrological, topographic and geological conditions. They occupy headwaters of streams and valley ..... environments and you can see in the aerial image up the top that the dry eucalyptus woodland matrix surrounds the upland swamp. Banksia thicket is on the upper and drier valley sides. Restioid heath and centre land occur on the wetter valley sides. And cyperoid heath and ti-tree thicket occupy the wettest valley sides and the ..... in the landscape.

These upland swamp communities are ground water dependent ecosystems and they rely on shallow aquifer groundwater in the sandstone bedrock to maintain high soil moisture in the root zone. This hydrological connection has been demonstrated by a number of researchers. Keith and ..... in 1993, there's a schematic here at the bottom from their work, their research looking at the hydrological gradient. And there's also more recent research that I led in Dharawal National Park showing the inherent hydrological gradient in these swamps. So hydrology is the primary driver for swamp formation.

Upland swamps provide valuable ecosystem services for human population. They provide regulating services including water purification, flow rate regulation, flood mitigation and carbon sequestration. Provisioning services include genetic resources and water supply. Wetlands provide supporting services to primary production, nutrient recycling and global water and carbon cycles. And I must also note that they are just beautiful landscapes, I took this photo on Maddens Plains in Dharawal National Park and it was just after a fire. And you can see the ..... were flowering on mass and the invertebrate activating in the landscape was incredible.

Coastal upland swamps, as we know, are listed as endangered under State and Commonwealth legislation, and a number of threatening processes affect them. Perhaps the least habitable and most pressing of threats is alteration of hydrology following subsidence ..... to longwall mining. And I won't go into a description of the disturbance, as you're well versed in the process.

Suffice to say that when mining disturbance occurs, it causes collapse, fracture and disturbance zones. The subsidence can be expressed at the surface, and here you can see a fracturing of the sandstone at the surface. The disturbance can profoundly alter the hydrological parameters of a swamp system, and that's what I'll be reporting in most part today.

Multiple tiers of governance, as we know, are in place to address ongoing declines in swamp extent and condition, and this is directly via conservation management and indirectly by implementing land use decisions through legislative and policy frameworks. And I know Lauren spoken about ecologically sustainable development, but I do think that it requires reiterating. We know that it is, in essence, there to provide for the needs of present generations without compromising the ability of future generations to meet their own needs.

The mitigation hierarchy helps deliver ESD, it requires developers to first avoid impacts and then sequentially minimise, restore and finally offset or compensate any unavoidable impact. In New South Wales, of course, ecologically sustainable development and the mitigation hierarchy are well-embedded in legislation and they're used as standard terminology in over 60 statutes.

Numerous government and industry reports have indicated that longwall mining is affecting swamp hydrology, but the evidence has been largely confined to the Grey literature and predominantly it's been anecdotal and qualitative. So we wanted to get a quantitative understanding of what the mining disturbance means for swamp hydrology.

We looked at soil moisture retention in the vadose zone, and this is a soil zone between the surface and the groundwater zone. We compared soil moisture in unmined and mined swamps. We were interested in how water storage and regulation functions of upland swamps may be affected by longwall mining.

Our study sites were located in eight upland swamps on the Woronora Plateau. Three sites were located above longwalls mined in the catchment area by the Dendrobium Mine, and this was specifically in area 3B, and these are the black squares on that. One site was above the mine footprint but it was not undermined at the time of data collection. And four further sites were located to the north and south of the mine in Dharawal National Park and on catchment land, and these are shown as the black triangles on the map.

The sites were representative of the hydrological gradient from drier banksia thicket to wet ti-trees ..... communities. At each site we established automatic hydrological

monitoring stations, each with three dielectric soil moisture probes connected to a data logger to measure moisture in the soil profile. The probes contained four sensors at 10, 20, 30 and 40 centimetres depth. Daily rainfall was measured using ticking bucket rain gauges and we controlled for a number of environmental covariables.

We tried to address the fact that the mine sites were necessarily clustered. We calculated some moisture persistence as the number of days after each rainfall event until soil moisture had dropped below 50 per cent. We used accelerated failure time models for the analysis. This figure shows persistence curves – they're the unbroken lines – plus or minus one standard error and that's – they're the dotted lines at a 50 per cent soil moisture threshold.

The mined swamps are shown in mustard and the unmined swamps are shown in blue. The data were collected from 2012 to 2017 and are separated into swamp sub-communities. By testing for differences between a) vegetation types, b) unmined and mined sites and c) an interaction of the two factors we were able to show a number of results. Firstly, we found very strong evidence for differences in soil moisture persistence between unmined and mined upland swamps after controlling for vegetation types and other environmental variables. And this is clearly shown in the figure most evident for ti-tree thicket and cyperoid heath. You can see those persistence curves recede much more rapidly in the mined swamps.

We were also able to shown that mined uplands swamps dried more quickly than unmined soils and that the mining effect was more evident for wetter than for drier vegetation types. But I should not that it was evident across all of the vegetation sub-community there – all of the sub-communities of swamps. The modelling also tells us there is strong evidence of hydrological differentiation. That is a hydrological gradient across vegetation communities in unmined swamps, but there was no evidence of hydrological differentiation in mined swamps. So the interpretation here is that it appears that the hydrological gradient is destroyed by mining.

We also found that soil moisture continued to decline with time since mining. So we are not seeing a stabilisation or a resumption of soil moisture level. The swamps are continuing to dry. And I just want to show – to demonstrate to you the sponge capacity of these swamp soils. I don't know if it's going to show – no, it hasn't. But, basically, I had a video of the – just to show how spongy these soils are. There we go. This is me lightly pressing a swamp turf that's been used in a related glasshouse experiment. And it's this water regulation and retention function that we stand to lose permanently if longwall mining proceeds.

For a subset of swamps we were also able to obtain piezometer data contemporaneously. So here I have a qualitative comparison of rainfall, soil moisture and groundwater level signatures in both unmined and mined swamps. On the x-axis we have time. So that's on the horizontal axis. And then on the y-axis we have hydrological signatures in the groundwater, vadose, and surface zones. And you can see that while the rainfall pattern is similar across both of the swamp types

the soil moisture and groundwater level responses are very different. In the unmined swamp we see persistence of soil moisture and groundwater levels for prolonged periods. In the mined swamp we see a transition to rainfall responsiveness with spikes in moisture when rain falls, but a rapid return to low soil moisture.

So, now, to tie in the policy implications of our research. We have provided quantitative evidence of persistent hydrological impacts of longwall mining. We know that these impacts are largely irreversible because all documented industry attempts at restoration have failed to re-establish pre-mining hydrological function. And this was demonstrated in a – in a Commonwealth review in 2014. We also know that upland swamps are geographically restricted in Australia, and this is reflected in their endangered status both at the state and federal level. I would argue that decision makers need to identify upland swamps as sites where targets are highly irreplaceable. They are not widely distributed and therefore cannot be offset or substituted.

Our mitigation hierarchy policy framework therefore dictates that upland swamps should be avoided when longwall mines are approved. Avoidance is the only approach to prevent further hydrological and biodiversity impacts. In the context of the current proposal there are options for avoidance. I note that the applicant indicates that avoidance of longwalls directly below upland swamps is technically feasible. Another potential option may be to undertake partial extraction of seams below upland swamps, but I must emphasise that this would require examination of hydrological responses if this came to pass.

In my research I'm now turning my attention to the trajectories of swamp communities after mining. In this cup and ball analogy of a state in transition model or regime shift. Different states are defining according – are defined according to different disturbance thresholds. I'm using glasshouse and natural experiments to follow the trajectory of swamp communities after longwall mining and prior disturbance. I think that upland swamps are set on an irreversible course with longwall mining causing de-watering and by removing above ground biomass ultimately causing the transition to novel non-swamp unity.

I think it's pertinent to return to a point I made earlier about cumulative landscape scale impacts of the proposal. What is before the Commission involves extension of an already extant mine footprint. So swamp level hydrological disturbance is actually replicated across the landscape with each of the mining areas butting up against each other. With time the swamp woodland mosaic is lost across the entire mine footprint. It's unclear where the functional tipping point lies, but in my opinion this cumulative disruption of an endangered ecological community is ill-conceived and reckless.

So, just in conclusion, our field results have indicated that underground mining cannot be out of sight, out of mind. Regulators need to ensure upland swamps are avoided at the planning stage to safeguard hydrological integrity and ecosystem function of upland swamps and the wider landscape mosaic. Thank you.

MR O'CONNOR: Thank you for that presentation, Tanya. I just have a question. From your research clearly you have a good understanding of the current role and function that these upland swamps play. Have you turned your mind, at all, to some of the climate change scenarios and the – the potential role they could play in future? Does it change at all? Does it diminish? Does it become more important?

DR MASON: Climate change is one of the threats affecting coastal upland swamps. It's a – it's a listed threat as well. So it's certainly part of – part of the problem for coastal upland swamps. And saliently, obviously, extraction of coal and use of it as a non-renewable resource and – it's going to add to the carbon, you know, problem and therefore climate change – it will exacerbate it. Is – so it's sort of a – a two pronged attack, so to speak, on – on the upland swamps in that sense. But certainly, in and of itself, as it stand now, climate change is a – a threat to upland swamps,

MR O'CONNOR: And just a second question. We had a speaker talk to us about the potential for upland swamps, if they're undermined and obviously disturbed, rather than being carbon sinks they might – might then release carbon to the atmosphere. Would you like to comment on that at all?

DR MASON: Yes. It's not my area of expertise. However, I have done a lot of reading around that as part of – on the upland swamps. And I – I agree with that. I understand that a lot of these swamp systems – it's more complicated. And I'm talking more the global literature. It's not necessarily a straight transaction but, I think, overall and certainly Kirsten Cowley recent publication in Science of the Total Environment indicates that it is a net carbon store at the moment. And that's certainly one of the ecosystem services that upland swamps provide. Disproportionate, sort of, capture of carbon.

So if – if the swamps lose their hydrological regime then they cease being swamps. And – and this is not – I note earlier you were talking about impact diminishing and I understand that with regard to water, entirely, but my understanding is that the impacts to swamps are irreversible and there will be no return to swamp communities once they've been undermined and dewatered.

MR O'CONNOR: Thank you. John, do you have questions?

MR HANN: No.

MR O'CONNOR: Richard?

MR BEASLEY: Just one. I'm sorry to ask a fairly obvious question, Doctor, but right at the very end with your slide about the transition or decline of a swamp to what you've called a non-swamp community as a result of the impacts of longwall mining, I take it a non-swamp community is a form of ecosystem, is it, that – where there's insufficient water for it to be considered a wetland or a swamp?

DR MASON: That's correct, yes. So there's the idea that they will go to a drier community, it's unclear exactly what that would be, but potentially just the surrounding woodland mosaic.

MR BEASLEY: A terrestrial system instead of an aquatic one, correct?

DR MASON: A terrestrial system.

MR BEASLEY: And - - -

DR MASON: Correct.

MR BEASLEY: - - - I guess it's obvious, but you're the expert not me, that impact is fatal to any member of the wetland ecosystem that's dependant on it being a wetland.

DR MASON: Correct.

MR BEASLEY: Yes.

DR MASON: Because they are so dependent on that hydrological regime, the extant hydrological regime that they've evolved - - -

MR BEASLEY: Yes.

DR MASON: - - - for to have various tissue or ..... in their – in the plant itself to deal with that anaerobic environment that they are adapted to. So as soon as that is removed then they can no longer exist. So your threatened species like pultenaea aristata, all of the frogs and the giant dragonfly and so on.

MR BEASLEY: All right. Thank you.

MR O'CONNOR: Thanks very much for your presentation, Tanya. The next speaker is Dr Ian Wright. Dr Wright.

DR WRIGHT: Thank you very much. Mine will be much shorter. In my opinion, the EIS underestimates the potential for adverse impacts and long term impairment to river ecosystems. Aquatic ecosystems need good water quality. Now, the EIS makes a statement that I find particularly misleading, I quote:

> *There have been no reports of any measurable effect on water quality in downstream reservoirs in the southern coal field.*

This is factually incorrect and I refer to the Water New South Wales submission to the independent expert panel on mining in Sydney Catchment of May 2018. This is a very informative submission and it shows multidecade rises of iron in Cataract and

Cordeaux, that they link to problems providing quality raw water to customers, including Sydney Water.

I've seen this data myself, in November last year I helped ABC TV interpret reservoir data under a DIPA request. Also showing much, much higher iron and aluminium concentrations in the waters of the Cataract and Cordeaux reservoirs, which have had more mining, and contrasting them with the less undermined Avon catchment. So I disagree also with the statements in the EIS that impacts to the aquatic ecology in surface orders would be localised, short term and minor.

In my experience, longwall coal mining can cause substantial and long-term impacts to stream and river ecology. Now, I base this on peer reviewed research I've conducted on subsidence and channel fracturing from Tahmoor Colliery on Redbank Creek from 2012 to 2017. This is between Picton and Thirlmere, it's not water catchment but it is ..... you can come in without the restrictions of a catchment, and it is also some of the only peer reviewed research done on this topic in Australia.

I found that the subsidence fracture sections of Redbank Creek had a combination of low dissolved oxygen, elevated salinity and elevated metals including zinc and nickel that together combine to create highly impaired water quality. The more sensitive stream invertebrates that are typical of clean waterways were missing due to the impairment of the water quality but also the interrupted flow of the channel fracturing and degraded habitat. I consider such impacts are likely in association with the proposed Dendrobium project.

Also importantly, the EIS fails to provide adequate information on how such subsidence damage would be repaired. And I refer to Dr Peter Turner's open letter to the Premier May 2020, of which I'm one of several signatories, it also questions the proven effectiveness of repairs to stream channel fracturing. So how can you create more of this damage if you can't fix it?

The other issue I'm going to look at is the south 32 use of Allans Creek to dispose of waste. I say south 32 because there's waste discharges from both this Dendrobium Colliery and also wastes from the south 32 Bulli Seam operations, which is condensed mine waste created from reverse osmosis. The impacts to Allans Creek is causing unknown and possibly substantial water quality impairment to the receiving waterways, and I don't believe there's adequate information to make a call on the extent of this impact.

The EIS does predict Dendrobium waste water to Allans Creek will increase from six to nine megalitres a day at the moment to 27.6 megalitres a day in 2035. Now, Allans Creek is a major tributary of Port Kembla Harbour estuary and the harbour is adjacent to Five Island Conservation Reserve – a small series of islands near shore waters, they're also popular for fishing.

What the EIS fails to mention is the current and future projected volume of the brine that is discharged into this creek from the Bulli Seam operations. Multiple

truckloads a day come, they're mixed in with the Dendrobium waste and I've seen sampling results – a citizen scientist sent me samples which I have tested. The brine is actually a salty solution with elevated metals: lithium, barium, strontium, copper, nickel, zinc and arsenic. The environmental impact of the two sources of these south 32 wastes, that is Dendrobium and Bulli Seam, are released into Allans Creek but there's only scant information on this.

I disagree with the statement in the EIS that the increase in discharge to Allans Creek from Dendrobium is unlikely to result in an exceedance of the EPL limits of Allans Creek. The EPA license, EPL 3241, authorises the discharge of very, very high pollutant levels and I'm concerned that this provides inadequate protection for Allans Creek and downstream aquatic ecosystems. Thank you.

MR O'CONNOR: Thank you, Ian, for that presentation. At the beginning you talked about the high levels of iron and, I think even aluminium, being noted in the Avon and Cordeaux water storages. The – can you just explain about what happens to that? Just sit on the bottom of the reservoir? Is, being a metal, you know, is it heavy and it – is it confined? Could it be easily removed? Can you just tell us a bit about that particular issue?

DR WRIGHT: Yes, that's a great question. And Peter, a couple of speakers ago, alluded to it. The metals appear to be building up in the sediment of the storage, that tends to become like the long-term pollutant memory. A bit like Sydney Harbour has dioxin levels, that pollution stopped 50 years ago in Sydney but we still can't eat fish in Sydney.

These metals are building up down the bottom and the data I saw via a DIPA request from ABC, you could see they take samples at different levels in the reservoir, it stratifies based on the temperature and density of water and there's much, much higher levels at depth. But in the severe drought of last year and when you've got, you know, waves and depending on temperature, what is at the bottom can actually come up to the surface.

So the – that's an excellent submission that Water New South Wales provided to that independent expert panel but it does link that mining activity with raw water quality problems. And I, you know, I note your point. They can apply artificial destratification and where the dam is able to select from different levels – they don't necessarily all have that ability. But it's a cumulative problem that's likely to become more problematic and, you know, under future climate it is likely as the levels drop – it's easier to recirculate these – your metals that accumulate at the bottom of reservoirs.

MR O'CONNOR: Thank you for that answer. John, any questions?

MR HANN: No, thank you.

MR O'CONNOR: That's all we have in the way of questions. Thanks very much for your presentation.

MR BEASLEY: Next speaker is Professor Stuart Khan from the University of New South Wales. Professor Khan. Might need your mic on, Professor.

PROF KHAN: That old trick. Thank you for the opportunity to present to the Commission today, I'm very grateful for it. I'd like to give a presentation if I can show a few slides.

MR BEASLEY: Yes, that's come up now.

PROF KHAN: You have it? Okay. So the topic that I'd like to focus on today is around drinking water and around the fact that this particular proposal is in a drinking water catchment, and what that means to – to Sydney and the Illawarra as drinking customers. So you – you will be already well aware that Water New South Wales have made comments on this proposal as it has been developed. They've raised a number of concerns already around the project design, water surface loss, stream fracturing, water quality and also a couple of issues around potential future infrastructure. I'm going to focus mostly on water quality, although I will just reiterate, I guess, that there are quantity issues that – that many of speakers already have raised around potential loss of water from the Sydney drinking water supply, potentially through catastrophic impacts, if we were to see a dam wall failure.

But more likely, inevitably, through induced leakage of water from storages, potentially just from impacts within the catchment themselves that affect runoff to – to the reservoir as well, which can impact the amount of water that's available. Water New South Wales was also concerned about how mining in this – this area might impact their ability to be able to construct future water storage infrastructure. So, of course, that would also have water availability impacts for – for customers, such as Sydney Water. And there – they include things such as the potential lower Cordeaux Dam project in the future, and a deepening – an access – a deep water access into Avon Dam.

But what I want to focus on are the drinking water quality issues. And, again, I don't think I need to go through the – the – the basic details, because you've heard it many, many times now, I'm – I'm certain. When you have underground mining, longwall coal mining going on in an area – we know from lots and lots of experience within the Sydney drinking water catchment, that that leads to subsidence at the surface. That leads to cracking of – of bedrock and of the – the sandstone rocks that provide a seal, effectively, under our waterways, that it opens up new surfaces. And when you have new surfaces exposed to oxygen, you have new chemistry.

New chemical reactions going on, and chemicals become soluble in water that weren't otherwise available to become soluble in water, in more weathered, exposed rock. So we do see concentrations of iron and manganese increased. Aluminium, sodium, potentially others, such as, calcium, barium, chloride. Carbonates,

themselves, can produce bicarbonate, which – which – which are ..... a water quality concern of their own under certain circumstances. But they also mobilise other chemicals. They form complex – as chemical complexes with other chemicals making them more soluble. So we have a number different reactions going on that is leading to circumstances like this.

I took these photos in 2014 when Water New South Wales took a group of us through the catchment and down the Waratah Rivulet, which is part of the catchment for Woronora Dam, just a little bit further north of where we are, and above the metropolitan coal mine. These are some of the things that we saw. Some of the damage that – that is visible where you have water. This – this pothole here is natural, but there – there is – it should be sealed. It should be full of water. There are escape routes underneath this rock now that the water just continuously flows through. It wasn't a wet day. It wasn't after an extensive period of wet weather that we were visiting.

But – but there are many, many water losses just like this. And we see significant cracks that run across the bed, in this case, of the Waratah Rivulet, one of the inflows into the reservoir. And – and this is the product after water has travelled down into some of those cracks and re-emerged. It's full of different inorganic chemicals, iron and manganese in particular. But it also becomes an environment that maintains the growth of various bacterial species as well. So there's a lot of chemistry and biology going on in this particular picture. Other areas we saw pools that had been permanently filled with water. Even right through the Millennium Drought, this particular pool had been filled and our guide from Water New South Wales verified that he had never seen it emptied before until this particular damage had occurred in this particular catchment.

And so this is long-term permanent damage to this catchment where we have a dried out – what was a pool. There have been remediation efforts. And the remediation efforts are commendable. Some cases with – with concrete that has been used to try and crack up – fill up some of the cracks in rocks. In other cases, there's polyurethane product, which is essentially no cracks that you can get from hardware stores, etcetera. It's – and this is all polyurethane down here. This is this synthetic product that you can see it has been squeezed of a – of a particular crack that there have been efforts to – to remediate in this particular part of – of the catchment.

And the other thing that you observe, when you go on a trip like this, is that there are bubbles, and these are bubbles of methane that are – that are being released from below and travelling up and continuously bubbling out through the water. I took this photo in 2014 in exactly the same place that this newspaper article from 2011 was about – where they were talking about methane bubbling up through one of the rivers, and this is it. The Waratah Rivulet, the same – same place. And there's a quote from the mining company, Peabody, down here in 2011 that says:

> *It will probably take three to four months to stop.*

The spokeswoman for Peabody, Jennifer Morgan, said. Look, this is a completely natural occurrence in the vicinity of – of coal mines. So, I guess, if you accept that coal mines are natural, then this is a natural occurrence and we should expect it to occur. But I think that the really important here is, they don't have a clue. You know, they're saying that this – this is going to go away in a couple of months. I took the photo three years later. I've heard anecdotal evidence that it's still bubbling now, and almost a decade later. So – so we really can't pretend that we understand these systems and we understand how they're going to respond in – in the future.

So now on to Dendrobium Mine. This was a news article, ABC Illawarra, published in – in 2015, where they had found that there had been damage that had gone beyond what the planning had predicted and – and what had – had been approved, or expected, anticipated, might be the right word. The important part is down here. In response to the report, South32 has released a statement saying that the mines impacts are within the approved conditions and the company will continue to meet all consent conditions. Environmental scientist, Dr Ann Young, said the problem lies with licensing conditions that are too lenient. So they've been allowed damage to legally occur. And that's effectively what's happening.

If we're not putting in place – if – if we're not assuming that the worst is going to happen, and we assume that adaptive management is going to effective in managing these – these problems, the we can expect to see a repeat of this news story in a couple of years' time, talking about the latest mining expansion. I think history has to tell us something, and we have to learn from – from history. One point that I really want to speak to, though, is this one: that I've been involved in workshops and – and seminars where we've look at these issues in the past and I've had – it has been put to audiences, and I've seen it in the media as well, that it doesn't really matter – for in terms of drinking water, it doesn't really matter what's going in the water catchment.

It's not a public health risk to – to consumers, because we can fix it at the water treatment plant. And it's true. We have great well-operated water treatment plants in – in Sydney. We use process like coagulation, flocculation, filtration. We can – we can manage water quality. We can blend poor water with good water. We – as you were just talking about, we can leave water in reservoirs to be diluted and a lot of the contaminants will accumulate the sediment. I just want to talk a little bit about why that attitude is really wrong and really out of step with the way that we manage drinking water in Australia. So the big document that – that oversees management of water quality in Australia, is the Australian Drinking Water Guidelines. And a quote from the introduction:

> *The Australian Drinking Water Guidelines are intended for use by the Australian communities and all agencies with responsibilities associated with the supply of drinking water, including catchment and water resource managers, drinking water suppliers, water regulators and health authorities.*

And – and when you open up the document, this point becomes very clear quite quickly. It talks about how we – we – we've restructured the water industry in Australia over recent decades, and now the – the organisations, the Sydney Waters that are retailing drinking water and treating drinking water, are somewhat separated in many cases from those that are managing the catchments. So this point is emphasised that – that catchment management is – is part of the framework, part of the responsibility for managing drinking water. And you see this expression repeated over and over again. It's catchment to consumer.

It's supposed to be a multiple barrier risk management process. We don't leave one barrier at the treatment plant to – to protect the community from – from poor drinking water quality. We manage it at multiple barriers from the catchment all the way to the consumer. The Australian Drinking Water Guidelines are part of the operational conditions for our water utility.

So they're written into the operating licence for Sydney Water, in this case. Sydney Water must maintain a management system that is consistent the with Australian Drinking Water Guidelines. The following clause is just say unless New South Wales Health comes up with something better, but in most cases, that's exactly what it is. It's you will follow the Australian Drinking Water Guidelines, and WaterNSW also have this requirement written into their – their operating licence 2017-2022.

With respect to the declared catchment areas, WaterNSW must maintain a water quality management system that's consistent with the Australian Drinking Water Guidelines or something better that New South Wales Health comes up with. So if we look at what that means, it means we don't just – in the olden days, the Australian Drinking Water Guidelines, we used to have a list of chemical quality contaminants that we had to meet, and the water quality to be below these – these numbers. We moved on from that with a big revision of the Australian Drinking Water Guidelines in the 2004 edition, where it's all about this framework for managing drinking water quality, and it's about understanding your system, maintaining the barriers to – to – to water quality, and preventing pollution at the source, as opposed to just worrying about the – the final water quality at the customer tap.

So when – when you open up the Drinking Water Guidelines, chapter 2 describes the framework for the management of drinking water quality. The very first point in chapter 2 says a preventative strategy from catchment to consumer. We're preventing contamination rather than dealing with that contamination at the end because if you do that, you leave yourself open to things going wrong. Treatment plants break down, and you have a water quality incident, and if you're managing it all the way along the line, then you have a much more reliable system for producing safe drinking water.

MR BEASLEY: That's just like having a series of redundancies.

PROF KHAN: Yes. Except I don't call them redundancies - - -

MR BEASLEY: Yes. Yes.

PROF KHAN: - - - because redundancies implies some of them are unnecessary.

MR BEASLEY: Sure.

PROF KHAN: You know, they are key components of – of the system. Who's – who's responsible for – for implementing the guidelines and where can we do it? It talks here about catchment management and source water protection. It refers to relevant agencies such as planning authorities. It says that:

> *Effective catchment management and source water protection include the following elements: ensuring the planning regulations include the protection of water resources from potentially polluting activities and are enforced.*

So we're already at the point of we should be referring to and applying the Australian Drinking Water Guidelines at this planning stage. It says:

> *In surface water catchments, preventative measures, the barriers that we can use, could include things like exclusions or limitations of uses, use of planning and environment regulations to regulate potentially water polluting developments* –

and it specifically refers to – to mining as an example of – of such developments. I did sit through and watch Lauren Sims' excellent presentation, and I know that you're already very familiar with the requirements of the State Environmental Planning Policy for the Sydney Drinking Water Catchment 2011, and – and specifically with item 10 down here, "development consent cannot be granted unless neutral or beneficial effect on – on water quality". So the need for the NorBE test.

So I won't go through this because you know what the NorBE test is. I will point out that – that the WaterNSW, back when they were the Sydney Catchment Authority, have developed guidelines for managed – for understanding or assessing – implementing the NorBE test, and I don't think you have to think about it too much to realise that none of these requirements are satisfied for there to be a neutral or beneficial effect on water quality, no identifiable potential impact on water quality. I think we can see from experience that we do have identified potential impacts on water quality, that that water quality be contained within the development and so it won't affect the water course.

That's not relevant because we're dealing – we're working in the water course at this point or that the water could be transferred outside of – of the water course. WaterNSW has done their assessment on whether or not the NorBE test is satisfied. Their conclusion is that it has not been adequately demonstrated that the project can achievement neutral or beneficial effect on water quality, and I would just like to make this very one last point that they've highlighted here. They've said they're particularly concerned about fracturing of streams that occurs downstream of

reservoirs. So all those pictures that I showed you of the Waratah Rivulet, that's all upstream. Upstream of Woronora dam. The water flows down into Woronora, the sediment. The – some of the chemicals end up in the sediment. It gets diluted.

In this case, we're talking about here are the reservoirs, Cordeaux and – and Avon, here are the dam walls, and then there are the rivers – the Avon River, the Cordeaux River, which then run down to become part of Sydney's drinking water supply by the Pheasant's Nest Weir. These – the potential cracking in these areas is what they're concerned about after the reservoir. So you're losing all of that dilation benefit. So I'll leave you with this line and – and challenge anybody to maintain a straight face while – while suggesting that this is evidence of a neutral or beneficial effect on water quality.

MR O'CONNOR: Thanks for your presentation, Stuart. Just going back to that point you were making about having barriers in place in accordance with the Australian Drinking Water Guidelines, do you want to comment at all about the cost effectiveness of that approach, rather than leaving it to downstream, you know, treatment? It's – it's, perhaps, a riskier approach, but is it a more cost effective approach?

PROF KHAN: I think that's a catchment to catchment, system to system question. I think that, you know, water treatment is expensive, and if we had to upgrade our water treatment plants because we had to deal with high concentrations of inorganic materials, in particular, are difficult to treat from water, iron, manganese sodium. There are very few treatment processes that are effective for removing inorganic salts, and if we ended up having to use high pressure membranes like reverse osmosis to reduce the salinity of water, that would be catastrophic. That would have a massive energy footprint and a massive cost impact to – to drinking water treatment, and therefore to drinking water customers in Sydney.

MR O'CONNOR: Thank you. John?

MR J. HANN: Professor Khan, part of the application and also in the department's assessment report refers to sealing of the – or the – the mine post development, post mining, and one of the implications that's stated is that you will get re-pressurisation of the ground water and therefore potentially an up flow of water back up into the service. What's the implication in your view in regard to water quality?

PROF KHAN: So WaterNSW also raised that point in – in the document that I – that I just quoted from. And they identified that as something that they are concerned about that you would get intermingling between – when – when the pressure returns to the – the ground water system. You – then you will get intermingling between the – the surface water and the ground water around the – the water catchment areas, and all of these same chemical contaminant concerns will then be transferred from ground water to surface water to drinking water.

MR HANN: Thank you.

PROF KHAN: Raw drinking water.

MR O'CONNOR: Other questions, John?

MR HANN: No, that's - - -

MR O'CONNOR: Richard?

MR BEASLEY: Professor, the site visit slide you showed us with the visit you did to WaterNSW where there was some examples of concreting and Polyfilla being used in cracks. I take it that's – that's not a realistic means of preventing deep water in the wetland or swamps caused from the cracks from longwall mining?

PROF KHAN: Beyond my expertise, I'm afraid, but – but what I can say is that I can – I was able to observe on that particular expedition that it had not been effective to eliminate impacts to – to water quality in that area, but I couldn't – I couldn't speculate - - -

MR BEASLEY: Had – had it been abandoned as an approach?

PROF KHAN: I – I don't know. I don't know the answer to that.

MR BEASLEY: All right. And just one thing from your – the slide you showed us, it wasn't clear to me, Mayor Quimby from the Simpsons, is he objecting to this proposal or is he in favour?

PROF KHAN: I think he's making excuses for it.

MR BEASLEY: Right. Okay.

PROF KHAN: He's suggesting that it doesn't matter if we damage the catchment because we can fix it later on, and that's the key point that I would like to make, that that's – that's not the way we think about and we manage drinking water in Australia.

MR BEASLEY: Thanks.

MR O'CONNOR: Thanks again, Stuart, for your presentation. Next present is Professor James Goodman. Professor Goodman.

PROF J. GOODMAN: Thanks very much.

MR O'CONNOR: Your slide presentation is coming up on the screen now.

PROF GOODMAN: Yes. Thank you very much. Yes. I'm speaking mostly on the question of greenhouse gas emissions. I'm speaking from Sydney, on Gadigal lands, never ceded. I'm a political sociologist at UTS, where I worked on questions of

energy transition for the 15 or so years and recently authored a book on the question of coal, energy and climate with Cambridge, just out this month. So what I want to talk about, really, is the impact of this project in terms of greenhouse gas emissions. And I want to stress throughout this question of impact as distinct from responsibility.

Now impact, of course, is written into the planning assessment legislation as the objects of that legislation in terms of socio-economic welfare and sustainable development and in terms of how the EIS process is described as assessing economic and environmental social impacts. And then the department's assessment itself used this language when it talked about weighing environmental impacts against the socio-economic benefits. So I make no apologies for focusing on impacts as opposed to responsibility.

This is important because the whole debate about climate change and of greenhouse gas – and the, you know, the significance of greenhouse gas emissions and the need to reduce them is all framed in terms of the impact of climate instability. And I'm not going to go into details of what those social ecological impacts are because you've heard a lot of that already.

But just to say that we're in a very important moment with regard to reducing emissions, the United Nations a couple of years ago pointed out that the planned greenhouse gas emissions globally would have to rise 300 per cent for us to have any chance of meeting the two degree target – that's 300 per cent on top of existing commitments under Paris. And this, of course, is forcing the gender beyond decarbonising electricity to electrifying transport and industry in order to reduce emissions in that sector.

So in the steel sector, for instance, it's said to produce around seven per cent of world greenhouse gas emissions, as now as I come onto a minute, an emerging and, in fact, urgent priority for that sector to decarbonise. In other words, to electrify on the basis of greenhouse – on the basis of renewable energy.

So just quickly, you will know the background for the Rocky Hill decision but, again to emphasise, this is about impact, the dire consequences of greenhouse gas emissions. The greenhouse gas emissions from this extension are 235 million tonnes above what would otherwise happen if this plant closed – if this mine closes in 2030.

When we're thinking about impacts, this debate about scope 1, 2, 3 is irrelevant. The only thing that's relevant here is the increase in emissions that will warm the planet, that will increase the greenhouse effect. So the debate on responsibility is moot. It's interesting, but it's a – they're a completely separate debate about what's on the table here which is what is the impact of this extension?

So what is that impact? Well, we can talk about the variations I said, socio-ecological impacts, but let's do it in terms of costs. And using the economic impact statement from Cadence, their cost – my gosh, sorry. They cost this at about $13 a

tonne. And this then, if you multiply $13 a tonne by 235 million tonnes you get more than three billion costs of abating the project, which then produces a net cost for the project – net cots of two billion. That's costing in the impact with the greenhouse gas emissions using the same costing as Cadence uses.

This is clearly a matter of injustice. South 32 says, "Our future is Illawarra's future," well, I would very much question that in terms of who bears the huge net cost of this project. And there are alternatives. And as I say here, Illawarra is not a coal commodity, it's a diversified service economy, has many low carbon strengths. South 32 itself talks about the need to work together to support the transition and reduce scope 3. It is itself diversifying and can diversify further, just like its former parent BHP.

BlueScope also has an objective in transitioning. The coal terminal, we can just look at what's happening in Newcastle in terms of thinking beyond coal. And then finally, of course, reindustrialising the Illawarra – the whole region may industrialise on the basis of hydrogen steel making. There's a huge opportunity here and this has been pointed out by many, including the IEA, which predicts that by 2050, 30 per cent of all global steel will be "green steel." And there's plants that have now – about to become operational.

So the – we – so the Illawarra has a 10 year horizon here, up until 2030, and in terms of continued – in terms of supplying BlueScope with coal. That's 10 years to plan a transition away from coal based steel industry and 10 years – well 30 years, in fact, to build the region as a renewable hydrogen hub. So there's enormous opportunities here for the region to avoid what would essentially be a lock in to a declining industry if this was to go ahead.

MR O'CONNOR: Thank you, James, that completes your presentation?

PROF GOODMAN: Yes.

MR O'CONNOR: Yes. I don't have any question. John?

MR HANN: No.

MR O'CONNOR: No.

MR BEASLEY: No, thank you.

MR O'CONNOR: Thank you very much for your presentation.

MR BEASLEY: Next speaker is Dr Neil Perry.

DR PERRY: Yes, hello. Thanks, can you hear me okay?

MR BEASLEY: Yes.

DR PERRY: Great. I'm on Gundungurra and Darug lands in the Blue Mountains and pay my respects to Elders past and present and emerging, and to any Aboriginal or Torres Strait Islander People in the audience. I don't have a screen to share, I'm just going to present like this. I'm an environmental and natural resource economist at Western Sydney University, so I specialise in the economics of environmental management which fundamentally relates to cost-benefit analysis and similar decision making frameworks.

I also design and teach cost-benefit analysis at Western Sydney University, I have qualifications in CBA and I've conducted CBA work for various government agencies. I have a secondary field in urban and regional economics which uses input/output modelling, so they're the two things I'm going to be talking about – CBA and input/output modelling in the proposal.

I guess I'd like to make six points, if I had enough time, about the cost-benefit analysis and the supply chain impacts. I'm sure the Commissioners know just for the people in the audience who may not, cost-benefit analysis is an economic framework for deciding whether projects should go ahead.

So it's fundamentally about the allocation of resources such as land, labour and capital and basically says that the collective willingness to pay for a project needs to be greater than the cost in terms of the value of those resources in their alternative use. Of course, there's criticisms of the ethics behind this and other issues, but I'm going to just stick with that framework and look at the way it's been applied in this case and the way the New South Wales guidelines to CBA for mining have been applied.

So the first point is that the pricing of greenhouse emissions in the CBA is not correct. In a perfectly functioning carbon market the price of carbon reduction or abatement and the credit price would be equal to the social cost of carbon – that's what we want, we want that price to equal the social cost of carbon or the marginal damages of carbon. In a perfect market that occurs because the permits are limited so that the marginal social cost is equal to the marginal abatement costs. Because of that limit, the price naturally equates to the marginal social cost in that perfect market.

In the CBA performed for this project the author uses the abatement price from the Federal Government's Emission Reduction Fund, which is around – I think it was $13, around that mark. But that market does not have a limit to the number of permits or rights to emit, it's only limited by the amount of money the government has deemed fit to put into the Emission Reduction Fund and that amount of funds has no relationship with the efficient level of emissions.

So the Emission Reduction Fund price does not have any relation to the marginal social cost of emissions. So that $13 is not the marginal social cost of those emissions. So instead they should use figures from the literature, which can be as

high – well, it ranges a lot but it can be very, very high – I've seen figures up to 130 UK pounds per tonne.

The authors also apportion the cost of emissions to New South Wales on the basis of New South Wales' contribution to global emissions in recognition of the fact that we only receive part of the damages in New South Wales. But the New South Wales guidelines and technical notes are very clear in stating that the total environmental impact of greenhouse gas emissions that is ..... to New South Wales should be included by attributable – I take this to mean that the total amount caused by us should be included regardless of where those damages are felt.

My second point, in reading the documentation, the Water New South Wales' submissions are very powerful. They indicate that the proponent has not demonstrated that the project would meet the mutual beneficial effect principle, and they note the irreversible impact on endangered upland swamps, and a potential impact on drinking water supply. This indicates to me that CBA is not the appropriate decision-making tool in this case. Instead, in keeping with the definition of ecologically sustainable development adhered to by federal and state governments, the precautionary principle should be used in this case.

That states that where there is a threat of significant reduction, or loss of biodiversity, a lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimise such a threat. There's a lot of double-negatives there. But, basically, it says that even though we can't say for sure that irreversible damage is going to occur, we should take action to avoid that damage. Taking action in this case is to reject the mining proposal. Third, in relation to the supply chain issues, or the interdependence of the court, BlueScope Steel, and the mine extension, it's argued that the rejection of the mine extension could lead to a cataclysmic cascade effect where the ..... is not liable if the mine is not approved, and, therefore, other mines in Illawarra are not viable, and then BlueScope is not viable, and this leads to a massive loss of income and jobs.

Contradicting that, they point out that BlueScope could source coal from Queensland, which would need a port upgrade of $200 million, which, of course, itself creates jobs and will keep the other mines open. So there's a contradiction there. But the main point here is that the modelling used to predict this cascading catastrophe is input/output modelling, and in one case, computerable general equilibrium modelling, which I'm very familiar with. Iron analysis, in particular, is not appropriate for modelling. Long-term impacts of job losses with no accompanying change, like modelling, of how the economy might change in response to those job losses.

So it's useful for some things, but it's static. It doesn't include price changes and movement of workers, which the authors note. And it doesn't include changes in input mixes. ..... is a bit better in this regard, but both models lack an ability to predict technological changes and new shifts in the economy. For example, the price of coal from Queensland could fall, or new technology could arise for, you know,

green steel. Regulatory changes might arise that change the nature of the report. It's simply impossible to make predictions of a cascading catastrophe, and, in fact, these are very rare and only really occur when private companies and the government fail to transition regions and workers to, in this case, a post-carbon economy.

Fourth point, back to the ..... The author, in proponent, has said that the benefits to workers is some $365 million in present value terms. To asset this, they state that that mining wages at around 195,000 to $200,000 per person, and that without the mine, these workers would be earning the average New South Wales wage of $66,000. So the get a wage premium, and they include that as part of the benefits. Now, the New South Wales guidelines are very clear that this should not be done. Those guidelines say that:

> *An appropriate starting assumption should be that workers do not receive a wage premium, even if they will earn more working in the mining sector.*

The guidelines do explain it in some cases it might be appropriate, but it needs a good justification, and the only one offered, from what I can see, is that workers in mining have a lot of capital to work with, and the disutility of mining is the same as the disutility of any job. This is not in accordance with the guidelines or logic. The guidelines say that any extra wage will – will be offset by the costs associated with greater hardship, etcetera. Logic says that these workers will find, you know, jobs elsewhere in the economy that are higher paying than the $66,000 assumed. Thus, the commission can discount that part of the CBA focused on worker benefits.

If the way that environmental offsets are being used in the CBA is not in alignment with the theory of cost-benefit analysis. CBA is about willingness to pay for, say, a new national park, or a new bridge, or road, and the opportunity cost to providing that park, bridge or road. The opportunity cost is the value of the resources, such as land, labour and capital in its alternative use. The way that biodiversity offsets and water offsets, etcetera, are treated in the CBA, is to say that because the impact on, say, upland swamps are offset, those impacts do – do not need to be considered in the indirect costs of the project. This is kind of difficult to explain. But offsets are very new, and haven't, to my knowledge, been theorised in the CBA literature.

But even when the company pays for the offset, there is a willingness to pay to avoid the original loss of the upland swamps and potential water impacts. This willingness to pay needs to be investigated and included in the indirect costs of the project, and they are likely to be substantial. They would be substantial because, even though offsets are good, they are nothing like the original. We value the upland swamps as they are. We're willing to pay for them to be maintained, even when the offset occurs. The problem here derives from the no-net loss assumption that underpins New South Wales biodiversity offset policy.

So the proponent can say that because they've offset via that policy, there is no biodiversity loss and we have taken the cost into account, or internalise the ..... But the no-net loss assumption is, firstly, only ever correct in terms of biodiversity

attributes, not the values or communities' willingness to pay with regard to biodiversity. In addition, in reality, it never actually occurs, because the offset site is often existing biodiversity and is protected, rather that new biodiversity created. The willingness to pay to avoid the biodiversity and other environmental losses, even when compensation occurs through offsets, must be included as an indirect cost.

Sixth, the CBA author and proponent has not attributed any value in the base case of no mining, or no mining after 2030, to the land around the facility and in the metropolitan special area. This suggests there is, from an economist's phrase, a free lunch. So they don't – there is no alternative use to that land, and so they don't value it. Because of the water supply network in the metropolitan special area, it may be appropriate to value this area in terms of the water supply values it produces and, again, the value of the upland swamps. Finally, this point about free lunch is actually more general. And I'm not convinced that the New South Wales guidelines are correct in the way they present some aspects of cost-benefit analysis.

Essentially, as long as the mining proposal is finally profitable, the BC ratio will be above one. The benefit cost ratio will be above one, because that means it produces surplus as positive, plus royalties and other taxes, and less the tiny leftover indirect costs. In fact, even if it was not financially viable, then the royalties and taxes could push it over the line. This scenario would suggest that the government should then come in and provide the mine. But if it does that, the royalties stop being relevant, because there are transfer and other taxes, stop being relevant, and then the BC ratio falls below one. So there's some ..... I believe it has to do with the way that the guidelines stipulate that the net producer's surplus is the benefit.

In this case, the percentage of the net producer's surplus – I think it's around seventeen and a half per cent, or something – something like that – is included because of the New South Wales ownership of the company is seventeen and a half per cent. That effectively means that only 17.5 per cent of the costs are considered relevant, including the internalised environmental costs. As I mentioned, CBA is about resource allocation. So the land, environment, and labour have an alternative use in New South Wales, and all of those costs should be included in the CBA. I get that the capital costs, we could just take seventeen and a half per cent of those, because they're owned by New South Wales residents, but the labour and land and environmental costs need to be considered in full. So if the guidelines separate revenues on the benefit side, and operating capital costs on the costs side, I think will lead to a different story. 17.5 per cent of revenue and capital costs would be included, but all the other operating costs would need to be included in total. That's the end of my talk. Thank you.

MR O'CONNOR: Thank you, Neil. I take it from those various criticisms that you've raised, that you would then say that the benefits have been overstated in the economic assessments that have been done. Is that a fair conclusion?

DR PERRY: Either – well, both. Benefits overstated, costs understated. Yes.

MR O'CONNOR: John, do you have any questions?

MR HANN: No. Not from me. Thank you.

MR O'CONNOR: Thanks very much, Neil, for your presentation.

MR BEASLEY: I think that's the break, Steve.

MR O'CONNOR: Yes. So we'll take a short break now and return at 12.25 pm. Thank you.

ADJOURNED **[12.00 pm]**

RESUMED **[12.24 pm]**

MR O'CONNOR: Welcome back to this final day of hearings in relation to the Dendrobium Mine Project expansion. We'll have our next speaker, please.

MR BEASLEY: Our next speaker is John Quiggin.

PROF J. QUIGGIN: Thank you. I'm a professor of economics at the University of Queensland, a former member of the Climate Change Authority, and I've – I've done research on both cost-benefit analysis and climate policy for many years. I want to restate some points I think you've heard in the previous evidence I've listened to in the previous section, but to start with an observation that this is a project with a very large amount of – of CO2 emissions associated with it. I estimate something like two years' worth of – of New South Wales total emissions if it proceeds as planned, taking place almost entirely within New South Wales save for the question of export doesn't arise, and yet the treatment of – the treatment in the cost-benefit analysis is such that the allowance for carbon emissions is negligible.

I think $100,000 over the life of the project. So I think that ought to advert us that there's something going very badly wrong here, that we can have such a massive project and yet it doesn't – doesn't appear to have any impact – any measurable impact or any – any impact supposed to take place on – in terms of the – the cost analysis. It's pretty clear that if the same procedures were used by other state level jurisdictions around the world essentially we would have no control over carbon dioxide emissions at all and would be heading on a path to a climate disaster. So I wanted to look at, well, what's – what's going here that – that's produced this, and I think there's a – two kinds of arguments that the – that they're using – three kinds, really, to – to justify ignoring – ignoring the carbon dioxide emissions from the project.

The first is that this is metallurgical coal used in making steel and the argument is – is, roughly speaking, that there's no alternative and, therefore, as long as the world is to have steel it will have to use metallurgical coal here or somewhere else and – and, therefore, we should ignore this. Now, that was a problematic argument a year ago, but I think it's – it's really changed quite dramatically in the past year. There have, of course, long existed alternatives, essentially a direct reduction of iron, as I've described in my submission, but what's changed has been a – a – a change globally but also in Australia in terms of perceptions of the viability of hydrogen – green hydrogen generation through electrolysis as an energy source in general and, in particular, as an energy source in metallurgical steelmaking.

So what we've seen just in this past year is that – so Queensland has made hydrogen production a central part of our recovery strategy. We even have a Minister for Hydrogen which is probably one of the first in the world and certainly indicates that we've gone from hypothetical alternatives to something which is – is planned to be well underway. We've seen a hydrogen introduction plan in South Australia, a large scale renewable energy project focused on hydrogen in Western Australia, and green hydrogen announced as one of the central elements of the Commonwealth's Government's technology roadmap. So all of these things, I think, say that rather than assuming, as the – as the benefit cost analysis does say, like it or not, we're going to be continuing the production of and use of metallurgical coal in steelmaking indefinitely in the future and certainly through the life of this mine to 2050, but we ought to be looking instead at the likelihood that there will be a rapid scaling down of – of the use of metallurgical coal in the future.

Not as rapid as with thermal coal but, nonetheless, one which says we should reconsider – reconsider whether we're going to restart facilities that are mines at the end of life and blast furnaces which require substantial methane. So in this case the – the Port Kembla Steelworks will require relining in late 2020s if we're to continue with blast furnaces. I'd suggest that if we are to evaluate those proposals we need to evaluate against the alternative of stretching out the likely existing mining a little bit further and then converting the blast furnaces to – to a hydrogen based steel production furnace when they're – when it – when it becomes necessary in 2020. So that's the first point I wanted to make.

The second points relate to the treatment of emissions of carbon dioxide, and I'm going to use – and also methane. I'm going to use the classification of the – of the Paris Agreements where – where scope 1 emissions are – are those emitted directly in the production process, scope 2 associated with electricity use, and scope 3 associated with the ultimate burning of the coal. And in this case scope 2 emissions aren't very important but both scope 1 and scope 3 emissions are substantial. Scope – scope 1 emissions are primarily methane emitted from the mining process. This is a particularly gassy mine and has high levels of methane and under the – under the Paris Agreements these scope 1 emissions are considered to be the responsibility of the jurisdiction where they're emitted.

So there's no question here about – even if the coal were being exported there's no question as to who's responsible for it. Essentially what the benefit cost analysis has done at – and as has previously been pointed out – is to ignore our responsibilities under an agreement we've signed internationally – Australia – and say, "Okay. Well, this is a New South Wales process. We don't care what happens to the 99.9 per cent of people in the world who don't live in New South Wales. We're only going to look at the impact of our methane emissions on people in New South Wales", and, to restate, there are great many New South Wales' sized jurisdictions in the world, all of them going through this kind of process.

If we – if all – everybody adopted this approach to – to emissions in general it would essentially be a planetary suicide act. We'd all say, "Look, we're only going to look at ourselves and only in these – in some national jurisdictions". So I think that's an – an entirely illegitimate procedure in the – in the benefit cost analysis and one which should really rule it out from any serious consideration as – as necessitate of the cost and benefits of the – of the mine proposed or until – until those costs are included I think it's unarguable that – that this a – a value deficient assessment.

The second, which is tricker, is – is the scope 3 emissions, and one of this is what happens when the coal's burned, but for most Australian coal, of course, that's happening overseas and under the Paris Agreements – under the Paris Agreement it is looked at as the responsibility of the importing country. But in this case the coal burning is also going to take place in Australia so the – and, indeed, in New South Wales, the primary part of it. So essentially the proponent's view is we can shunt responsibility off to that from the – to the steelworks and, further, we can assume that nothing will ever be done because if – if they took this view and the steelworks then said, "Well, we're going to" – or the New South Wales Government said, "We're going to introduce carbon price in line with the direct social costs", that would radically affect the economic viability of – of the mine.

So, again, they're not only – not only trying to shift responsibility to something which is clearly the responsibility of New South Wales but, in addition to that, the – the procedure really is working on the assumption that – that the commitment – the overarching commitment that was made in the Paris Agreement which is to reduce our national emissions to a level consistent with less than two degrees of warming are that we're actually not going to take any serious action on those – on those – on those commitments that they can assume that the demand for metallurgical coal in Australia – to be burned in Australia is going to continue unabated until 2050, a time when most national jurisdictions have committed to a net zero – a net zero time.

So those are my – those objections, I think, to some extent been raised previously, but I – I feel it's important to restate them. We're simply looking at both the out of date treatment of – of hydrogen and the completely unsound treatment of scope 1 emissions along with lots of other points that could be criticised, and it's my view that this assessment can't be entered. Thank you.

MR O'CONNOR: Thank you, John. Can I just go back to the beginning of your presentation and you asked or – sorry – you – you mentioned that there's a nominal $100,000 cost being included in the cost-benefit analysis for the – the carbon emissions – the greenhouse - - -

PROF QUIGGIN: Yes.

MR O'CONNOR: - - - gas emissions from this project. Can you just explain what – what that is, that 100,000, and how it's been calculated - - -

PROF QUIGGIN: So this is - - -

MR O'CONNOR: - - - and what it relates to?

PROF QUIGGIN: Yes. So this is – if the scope – scope 1 emissions or methane that's emitted from – from the mine. That contributes a certain – that contributes – contributes damage to the atmosphere, but what's been done is to say, "But we don't care about what happens outside the border of New South Wales". And of course that methane is emitted into the atmosphere and extends with all the other greenhouse gases, and so only .1 per cent or thereabouts of the – of the total impacts falls in New South Wales. The rest falls elsewhere in Australia or elsewhere in the world and so, therefore, they can divide, roughly speaking, by 1000 the damage that's done in their scope of emissions.

MR O'CONNOR: And that's how the $100,000 figures are derived, is it?

PROF QUIGGIN: That's as I – as I read what they've done, yes.

MR O'CONNOR: Okay. Thank you. John, do you have a question?

MR HANN: No.

MR O'CONNOR: No. Richard.

MR BEASLEY: Nothing from me.

MR O'CONNOR: Thank you very much, John, for your presentation.

MR BEASLEY: Our next speaker is John Pye.

DR J. PYE: Hi, everyone. So I'll – I'll go ahead if you're ready.

MR BEASLEY: Yes. Please go ahead.

DR PYE: All right. So my name's John Pye. I'm a senior lecturer at the Australian – at the ANU Research School of Electrical, Energy and Materials Engineering. I'm also a convenor in the ANU Energy Change Institute and we've been doing some

work recently on zero carbon energy for the Asia Pacific. It's a grand challenge project looking at opportunities for – for Australia to transition to various kinds of zero carbon energy exports. And so this is a presentation I've – I've given as a result of that work and then I've been asked to give it here again for you. Okay. So the scope of this talk – yes. I'm going to – I'm going to give a bit of a quick overview of the steel/iron ore industry, Australia's role, conventional steel versus green steel, some points about local advantage and – and – and potential scale and a couple of scenarios and then – and then outlook.

I'll just make sure I'm keeping track of the time. Okay. So in context, I'm sure you've had other speakers talking about this. The – Australia's signed up to the Paris Agreement and the IPCC did a major study which they released in 2019 looking at the scenarios of 1.5 degrees of warming and there are a lot of – a lot of details in that study talking about the – the damage to the environment that's – and the experiences that people are going to have at 1.5 degrees of warming. If we want any chance of staying on track for – for 1.5 degrees of warming where already the impacts are large, they estimate that we need to be removing 59 per cent of our current use of coal as soon as 2030 under all scenarios.

Most of the scenarios resulted – required an even greater reduction. It all depends on negative emissions and other things that are being done. So we have a need for rapid reduction to minimise environmental damage and you've heard over the last year there have been major pledges from most of our trading partners in – especially iron and steel and iron ore – Japan, Korea and China all making net zero CO2 pledges. New South Wales has its own pledges. The US is expected to make a pledge in 2021 under the incoming President-elect. And the EU made a pledge in 2019 which it's now moving to make legally binding and all sorts of discussion about carbon border taxes that will have implications for our trade in fossil fuels and – and steel as well.

So I'm sure you're already aware that steel is a big industry globally and a big one in terms of emissions. On this particular analysis which was cited by the IPCC – it's a sector based analysis which – as opposed to some that, sort of, pull of electricity as a particular area, this one divides it by the, sort of, end use and industry's 32 per cent of global emissions and steel is 19 per cent of that, so a very significant part of global emissions. And it's been growing. Steel production's been shooting up as a result of a massive expansion of the Chinese economy and China produces now a – a – a good amount over half of global production. Australia – Australia's production is a very small fraction of the – of the global total in this industry.

Steel is mostly used in buildings and infrastructure. That's where a lot of it's been going in the – in the big Chinese expansion but also automotive mechanical equipment and other areas. Our production of iron ore which goes into making all this steel is 99 per cent coming from the Pilbara region in North Western Australia. This is a – an enormous export area for Australia and we are the largest exporters of iron ore in the world and most of our exports go to China, with a fraction going also to – to Japan and South Korea and a number – number of other smaller markets.

And our big companies involved in exploiting the iron – Rio Tinto, BHP, Fortescue and Grange Resources is a – another interesting one in – in Tasmania that exports pellets rather than unprocessed iron ore. The different pathways to – to steelmaking – we have blast furnaces which use metallurgical coal which is converted to coke which then goes into a blast furnace and is burnt, and then you have a – a liquid hot metal which is further processed in a basic oxygen furnace. We also have the shaft reduction process which is a – used much less but is under increasing interest and development and then the direct reduced iron making process, which is currently around six per cent of global production and has significantly lower emissions and mostly is done using natural gas as the fuel and pellets as the iron ore feed.

The blast furnace route is responsible, as – as it says just back here, for about 93 per cent of global production and uses a huge amount of – of energy and – and the emissions arise primarily from the blast furnace stage. There's energy associated with all the downstream stages. A larger fraction of energy is electric in those stages. In the blast furnace the energy is – is combustion of – of coke produced from coal. The direct reduced iron making pathway is – is the interesting, sort of, basis for increasing work towards decarbonised steelmaking.

Direct reduced iron making, as I mentioned, uses natural gas, which is processed in a steam methane reforming process which turns the – the natural gas into carbon monoxide and hydrogen which then essentially goes into the – the shaft furnace and – and – and acts in place of coal. And this – this – this so-called MIDREX process is – is about 70 per cent of global DRI capacity. Countries that don't have so much coal have the majority capacity in this process – India, Iran, Russia and Mexico – but there are plants in the US and – and other places too. So there has actually been some experience with direct reduced iron making in Australia.

The Boodarie Plant that BHP built in North Western Australia was – was actually a FINMET process, not quite the same as MIDREX, but using natural gas to – to produce hot briquetted iron which was – was then exported to our overseas markets. So this basic idea has been – typically runs at about 40 per cent hydrogen but it has been trialled at up to 90 per cent hydrogen in – in a couple of isolated demo plants and work is – is continuing afoot on – on – on improving and refining these processes. One of the most recent advances has been from work in Sweden. This is the HYBRITs process which uses an electrolyser to produce hydrogen.

The hydrogen can be stored and it goes in as the fuel to a shaft furnace which – where it reduces iron ore pellets that allows an intermediate product which is hot briquetted iron which can be also stored and then run through an electric arc furnace to complete the – the process. The costing of this process that's been done you can see on the right indicates that obviously it's very sensitive to the cost of electricity that the – the total production cost of the – of the liquid steel is very sensitive to electricity cost because of the cost of the electrolyser and the energy that it needs. However, the – I've highlighted in yellow the current cost of photovoltaics and wind which is really now at the low end of this scale.

That's the cost of just the raw photovoltaics and wind. We need additional costs for energy storage but these things have been reducing and we now hear people talking – I think credibly – about green steel – notice there's a – there – there's only a very small amount of – of carbon and emissions associated with this entire process to the electric arc furnace, the – the, sort of, final adjustment of the quality of the steel, and this is dramatically lower emissions from this process. And – and that's because – this is becoming possible because of the declining costs of – of renewable energy. The status of this plant is that they've started up their prototype plant and they're working – I think that's of the order of 100,000 tonnes per year.

And they've now announced just in the last couple of weeks that they're going to be building a 1 megatonne per year demonstration plant the next stage up starting in 2023. Other efforts – a big effort in Europe, but – but not only Europe. In the US a completely different process has been developed which is direct electrolytic iron making, that they've actually produced some at a – a prototype – small prototype scale. There's a project in Europe that's also direct electrolytic steelmaking. There's all sorts of efforts, including by Tata Steel in Europe on – this is actually originally Australian technology, HIsarna process, developed by Rio Tinto, which can be combined with carbon captured storage and result in maybe a 75 per cent reduction in CO2.

But the really big reductions in CO2 can come from the hydrogen steelmaking, so you've got ArcelorMittal and MIDREX pushing forward on MIDREX hydrogen. They initially were proposed to use steam methane reforming for their hydrogen but to migrate later to a completely green electrolysis hydrogen. We've got Pryor Metals working on a fluidised bed process also in – in Europe in – in Austria. They're very interested in the prospects of applying their process to – to Australian iron ores where we have 70 per cent of our exports in fine – fine ores instead of lump ore and this is very applicable to that. Again, 100 per cent CO2 reduction is – is feasible, minus the small amount necessary for – for line and adjusting the carbon content.

Thyssenkrupp has recently announced that they can inject iron into a blast furnace. A blast furnace still needs coal to hold up the – the ore and to allow porous flow through the furnace so this technology is applicable for perhaps a 20 per cent reduction in CO2 emissions but can be applied to existing infrastructure. And Salzgitter has got a whole program of gradually migrating the blast furnaces through to – to hydrogen DRI in a, sort of – a – a transitioned approach which they're promoting. So there are lots of research programs, huge investment in – in Europe in this. There's a whole European plan to transition steelmaking to carbon neutral by 2050, and they're going – they're going at this very seriously and they're interested to engage in Australia.

Now, there's a local advantage that Australia has in this whole industry. If we compare with the big areas of steelmaking in China on the coast there, the Pilbara where our iron ore comes from has a dramatically higher solar energy resource. We should probably look at the PV one because photovoltaics is much cheaper than concentrating solar. Wind resource in this area is also very good so we have an

excellent energy resource. But even if we're talking about Port Kembla, the – the area – the – the surroundings of – of that area still have significantly cheaper, more abundant renewable energy resource. That transfers to a cost reduction, a saving in the – the energy that would be required for hydrogen based steelmaking from electrolysis.

We could be at a 30 per cent advantage relative to the – the production of electricity from photovoltaics in Eastern China. Now, Bloomberg is not the only people that have made forecasts on the cost reductions in – in hydrogen, but – but here are theirs. They – they project that hydrogen's going to be coming down greatly in price as a result in further reductions in the cost of photovoltaics and wind. We've seen 90 per cent reductions in the last 10 years and that's still going on. There's also been in the last four years – five years, I should say, a 40 per cent reduction in the cost of alkaline electrolysers and even greater reductions in China.

And so green hydrogen's projected to overtake fossil derived hydrogen from – from 2030 and onwards. And on the basis of that, Bloomberg predicts that hydrogen based steelmaking will start to be cost effective, depending on the – the costs of – of coal that you're dealing with, from – from 2030. And, incidentally, the European Steel Association predicts that – that by 2050 – is that bell indicating I have one minute; is that correct?

MR O'CONNOR: Yes.

DR PYE: Okay. So they're predicting about a 30 per cent – 30 to 100 per cent premium for the price of green steel and yet as a – as a region that's what they're committing to doing. If we go ahead with processing all of our iron ore by this method we would need a massive amount of energy – seven times our national and – the national demand. I'm not proposing that that will happen, but the – the scale of this activity is – is nation scale. There are a number of different scenarios that could go forward with all of this. We could export sinter or pellet to China. We could export hot briquetted iron to China, Japan, Korea, or we could – as we do in Port Kembla – make complete steel and potentially be very competitive at that as a result of low energy costs.

I won't talk too much about the – these issues other than to say that cost of labour and energy are very important parts of the – of the mix. We see a transition all the way to decarbonised steel by 2050 being essential to meet the emissions reductions targets that we've committed to as a nation. I'll finish with my key points from this talk as they apply to the present matter. From 2030 hydrogen based steelmaking is forecast to start to become competitive with conventional steel without a CO2 price from 2030. There are numerous companies that are developing, prototyping and demonstrating the relevant technologies.

Under these conditions that I've talked about I think that securing a long term coal supply may no longer be necessary or justified. It looks like we might only need to be talking about a 10 year horizon or perhaps a little bit longer for – for the

continuing conventional production of steel. And I've highlighted all those national initiatives to – to reduce emissions. Australian steel producers could benefit – will – would benefit or will benefit from large, local advantage in the likely evolution of renewables based steelmaking and I – we already see engagement and interest from the relevant companies in the steel sector to undertake this transition. Thanks very much for – for your patience.

MR O'CONNOR: Thank you for your presentation, John. Any questions? Richard.

MR BEASLEY: Just on the – the – what you just said there, John, about 2030 being the likely date where production of what we'll call green steel becomes commercially competitive with producing steel using coking coal, who's leading the world at the moment in relation to developing that technology?

DR PYE: The – I would say the – the region that's leading the world in that technology is – is Europe but they're certainly not alone. There are activities here in Australia. There are some initiatives – quite major initiatives in – in the US, Japan and Korea as well, but – but Europe's driven it the most quickly, I would say, because they've – they've gotten together and – and set some targets for the industry. And they're investing in a lot of really leading R and D and most of those research and development efforts that I highlighted were – were in Europe.

MR BEASLEY: All right. Thank you.

MR O'CONNOR: Thanks again for your presentation, John.

DR PYE: Okay. Thank you.

MR BEASLEY: Next speaker is Prudence Wawn.

MS P. WAWN: Hi there. Can you hear me?

MR BEASLEY: Yes, please go ahead.

MS WAWN: Okay. Hi. Look, hello to everybody. I'm speaking today from Garigal land, and pay my respects to all First Nations people. I'm a member of an activist group called Water for Rivers, formed in response to the Murray Darling Water Crisis and collaborating with affected communities to return water flows to the natural environment. The reality is Australia's leaders and their policies are turning this country into a dust bowl. Project – damaging project on this driest of continents are readily approved with no accounting for the accumulative effects and impacts on our water. The best antidote to fire is water. Yet, here we are, straight after the fires, the 850 gas wells got approved despite expert warnings of considerable risk to the Great Artesin Basin.

That shocking decision prioritising vested interests over our shared natural resources and a safe climate confirmed for many that the system is broken. How can we have confidence in a government process that disregards so much independent expert scientific evidence. The recent independent ICAC investigations found New South Water Policy unduly focused on irrigators' interests, and that the government's actual water policies were inconsistent with the law. As we all know, miners occupy the same privileged position. They are, by far, the most protected species. A researcher with the Australian institute said that just .8 per cent of resource projects have not been approved since the commencement of the EPBC Act.

Yet the Federal Government response to the Samuel review is to tear up the specific rules, remove Commonwealth oversight to establish a single touch approach in order to streamline the process. The Federal Government has pushed their EPBC Amendment Bill 2020 without even any national standards in place, even removing the water trigger exclusion. So instead of building up environment protections as climate change kicks in, our Federal Government is engaged in the deconstruction of the administrative state to reduce obstacles in the way of making a profit.

This is what corporate money buys under unbridled capitalism. George Monbiot calls it The Pollution Paradox. Basically the dirtier or more damaging an enterprise is, the more money it must spend on politics to ensure it's not regulated out of existence. As a result, political funding comes to be dominated by the most harmful companies which wield then the greatest political influence. How can we have faith in the responsible New South Wales government agencies who are now suffering from chronic underfunding, inadequate scientific auditing capacity, inadequate or non-existent water monitoring, administrative failures, organisational dysfunction and a lack of commitment to compliance according to the ICAC findings.

So here we are again, frustrated citizens battling a government that has a tragic history of failing to follow appropriate water management and water sharing principles, leading to expensive disasters, as we've already seen in the Murray Darling river basis and elsewhere. It's common knowledge that this project will drain coastal swamps, dehydrate eco systems, creating a more fire prone environment. That the DPIE endorses the expansion of this mine, despite the prospect of this water loss continuing in perpetuity with no solution provided by the proponent is deeply troubling. Yet, the technology and resources exist for producing green steel, and that's where we need to go. A dire situation we face with global warming certainly does not support the expansion of the Dendrobium coal mine, particularly within a legislative regime lacking the integrity to protect the natural environment that sustains us. Thank you very much.

MR O'CONNOR: Thank you, Prudence, for your presentation. Any questions?

MR BEASLEY: .....

MR O'CONNOR: Not from me. Next speaker is Ann de-Leuw.

MS DE-LEUW: Good afternoon, commissioners. Thank you for the opportunity to speak today in support of the Dendrobium Mine Extension Project. My name is Ann de-Leuw, and I'm a second generation member of the mining industry. My father was an underground miner in the local area, and my brother completed his apprenticeship as an electrician in a local mine and now has his own business providing employment services to the local region. My family arrived in Australia as part of the 10 pound assisted passage scheme from the UK in the mid-sixties. It was a time when Australia called for skilled labour to help make this country great, and my father answered that call.

Uprooting us from Scotland, Mum, Dad and five kids, for a job in the beautiful Illawarra with a promise of a great future. He commenced in the steel industry, and then quickly transitioned into coal mining. My dad was a proud and respected miner for over 30 years, and he, along with his colleagues, have helped to build and grow this great region of ours. I personally have over 26 years in the mining industry and have had the pleasure of working at the Illawarra Metallurgical Coal mines of West Cliff, Appin and most recently Dendrobium, and now I am at the regional office.

I've held various roles, HR advisor, team assistant, and executive assistant. I am fortunate that this career has allowed myself, my husband and my boys the opportunity to continue living in this beautiful area. They've been schooled in the local area. We've been able to work within close proximity to our home, to shop local, supporting the businesses in the area, and continued to watch this great place we call home thrive and grow off the back of over 2000 employees at IMC and their families who are just like us. The camaraderie in the mining industry is one most work places would envy.

The focus on safety, the diversity, and the fact that the company is both family orientated and flexible makes it an attractive career. Our product, metallurgical coal, forms part of everything we do in everyday lives. It is coal for steel, so from cutlery to cars, washing machines to wind turbines, our coal for steel is part of our entire day. There is currently no commerciality viable alternative to steel making, and our product is used domestically and internationally. It is sought after coal for steel product. I worked on site at Dendrobium mine for over two years.

During this time, I had the pleasure of getting to know the people, the processes, the procedures and learn about how we give back to the community and our region. Dendrobium Coal Enhancement Program (DCEP), is currently funded by over 4 cents per saleable tonne of coal from Dendrobium mine, which goes to support activities and provide broad community benefit . The DCEP is administered by a board comprising of several community and company representatives, and it has committed to making contributions towards the sustainable development of the communities surrounding South32's Dendrobium operations providing funding for a three year robotics and coding program for all students at Mount Kembla Public School, valued at $60,000.

We also provided $53,000 in funding for a library refurbishment last year to support learning and encouraging reading for young learners. We fund and co-host the 96 Candles Memorial service yearly, and most recently the DCEP approved over $170,000 in projects, including co-funding a new playground area with Wollongong Council in Mount Kembla and supported subsidised visits for Life Education's Healthy Harold van to visit a number of schools in the Illawarra region at little to no costs to the families. Since the program's inception in 2004, Dendrobium mine has committed more than 2.2 million to fund – to this fund to support the local area.

Should the extension project be approved, Dendrobium mine's financial contribution to the DCEP will increase in line with consumer price index, and we will continue with the same process to administer the funds. South32 is committed to creating shared value and making a positive contribution to the quality of life of the communities in which we operate. We work hard to consult with our community, and we have a community consultative committee known as the CCC who we meet with on a biannual basis. We have a community team to – who work with the CCC and the community to assist with operational and community matters including requests for funding.

The team manages a 24/7 community call line and email address with any inquiry we received responded to within 24 hours. I am proud of how IMC contribute and support our community and the local business, the economy, and provide jobs for our strong and diverse workforce and for the opportunities offered for next generation of miners. There have been some concerns raised through the hearings about the aspects of our work, but I am confident that our team of experts have laid the groundwork to ensure we are responsible, that we are reliable, and that we are sustainable now and well into the future. For that reason, and for the continued long-term social and economic benefits IMC offers to the Illawarra region, I am proud to speak in support of the project. Thank you, commissioners.

MR O'CONNOR: Thank you, Anne. Any questions, John, or Richard?

MR BEASLEY: No. No, thanks.

MR O'CONNOR: No. No questions. Thanks for your presentation.

MR BEASLEY: Next speaker is Julie Sheppard.

MS SHEPPARD: Hi. I'm here and I'm ready to go. Can you hear me?

MR BEASLEY: We can hear you.

MS SHEPPARD: Brilliant. Look, I understand you guys were taken out on a site visit by South32 last week which should have given you a good overview of what you were being asked to approve, but you were shown little or no damage. I want to correct this serious omission by illustrating the full range of observable impacts that are – have occurred. And I can do this because I served on the Dendrobium CCC

since its inception in 2002 and attended every field inspection from 2005 when mining actually began to 2015 when I resigned from the committee as well as many independent inspections with the then SCA, later WaterNSW, and during the Southern Coalfield Inquiry in 2007. My 10 plus years of observations can also be confirmed in every ..... panel report produced by the company as the mining progressed.

Now, I'm going to show you some pictures. So the range of impacts – well, firstly, I'm just going to talk about the subsidence and the induced impacts that relate to swamp draining, stream bed cracking, loss of surface flows and contamination of water. I'm not going to talk about gas venting or disposal of coal reject material. I haven't seen gas venting at Dendrobium although it happens elsewhere. That's not to say it doesn't happen at Dendrobium. And disposal of coal reject material – I haven't got time to do that, but I'm going to deal with that very sore point in a written submission.

Now, this is a very large, beautiful and healthy swamp. It's Dendrobium Swamp 1A in Area 3B. In 2012, pre-undermining. Note the banksia robur, an indicator species in the swamps. I haven't been back to see it post-mining but I know you saw its neighbouring Swamp 1B on your site visit and it was noted to be relatively dry, which is very sad to hear, after all the rain we've had. Now, the very first swamp to be undermined at Dendrobium was Swamp 1 in Area 2 in 2008. It was a small shallow swamp and showed obvious impacts very quickly. It has exposed sandstone bedrock to one side and you can see the cracking which extended across and through the now dry sediments so that this swamp completely dried out very fast and the banksia robur was dying off first.

Despite the obvious cracking BHP refused to admit for some time that this drying out was due to mining. Now I'm going to spend some time on another swamp, 15B in Area 3A, which was undermined in 2011 and 12. And to show you how clearly undermining affects a swamp and its outlet creek. Now, this is 15B pre-mining. Very lush with a different assemblage of flora to 1A in my first slide but here with the bright green coral fern predominant and banksia robur still there as the indicator plant. Now, all swamps have an outlet or exit creek, a first order stream where crystal clear water seeps out slowly and continuously even months after rain so that a base flow is maintained and water is retained in the landscape. The creek below 15B was typical. Tumbling over small cascades like this, forming permanent pools along the way which harboured a suite of aquatic life, and joining up with other creeks that all head downhill towards the water storages. You could safely drink this water.

And here's the confluence with a larger stream from a bigger neighbouring swamp, 15A. And this water all then drained into Lake Cordeaux via Sandy Creek Waterfall. Now, this graph, like the vital signs monitor of a hospital patient who has died, dramatically shows how undermining has killed this swamp. The immediate response when the first longwall passed beneath, and that's the green line, is that the water level plummets and then flatlines. There is no further response in swamp water level after rain. The second longwall 12 months later, the pink line, seals this

swamp's fate. The next series of images from June 2013, eight months further on, shows a dewatered, shattered landscape that was very depressing to see.

The once lush swamp vegetation is now drying out, with the banksias doing poorly. Because the growing conditions are now so much drier, dry sclerophyll vegetation has already started to invade. This is persoonia levis which would not normally be found in a swamp. The outlet creek is now dry. This shallow puddle is from rain the night before, not from normal flow. As we move further along the rocky creek bed became a shattered mess. This was once a clear – delightful clear pool, but now bone dry. The fluoro tape shows the former high water mark on this pool. All aquatic ecosystems become locally extinct under these conditions. There's also no standing water for other creatures, birds, reptiles, mammals. Creekside vegetation is dying off.

And now we're in the sandy bed section which is bone dry as well. Now we see some water re-emerges after travelling sub-surface, but this water is contaminated by chemicals, especially iron. This will leach from all the broken up rock surfaces that the water has passed through. Now the water has disappeared again, but at some point a contaminated slug has passed through leaving this orange coating behind. There was no water discharging at the nearby confluence with the creek below 15A. Now, this scenario has been repeated in some form at every swamp – every undermined swamp and outlet creek.

Here, in 2015, at Creek WC21 below Swamp 8 in Area 3B there was still plenty of flow in this section but it's obviously highly contaminated with iron. I doubt this flow would still be there now, though, as almost the entire two and a half kilometre length of this creek and its three associated upland swamps have now been undermined by seven successive longwalls. And the water quality is not good. Not what you'd expect in the drinking water catchment. The contaminants are predominantly iron, aluminium and manganese. And you certainly wouldn't want to drink this water. And this other slide shows you that the oxidised iron attaches itself to everything via a bacteria that feeds on it.

Now, as we've seen, swamps that are undermined lose the water in their sediments that made them swampy. And this makes them extremely vulnerable to fires. A healthy wet swamp will not burn beyond the plant tops above the ground, and because the roots remain intact they regenerate quickly. A dried out swamp, however, will burn right down into the peaty sediments. And if heavy rain follows the bared sediments are then extremely erodeable and can be washed away causing complete collapse of the swamp. During the Southern Coalfields Inquiry in 2007 we, along with the panel, were shown Swamp 18 above the old Elouera mine on Native Dog Creek. It was undermined in 1994 to 98. It burnt in December 2001 and eroded after heavy rain in 2002. Channelling causing great canyons to be formed.

This is what we saw five years later. The black banks of sediment on the sides of these canyons are now rock hard and the dry sclerophyll vegetation, wattles and eucalypts, have moved in. This is now no longer a swamp. And these recent images

of Native Dog Creek below Swamp 18 show the impacts are long lasting. 25 years after the undermining much of the creek is still bone dry. But then, again, some water re-emerges, heavily iron stained. And this is just near where the creek drains into Lake Avon. Ground cracking.

Now, the EIS says that the slopes in Areas 5 and 6 are expected to experience the full range of movements with crack width expected up to 400 millimetres. And these alarming cracks appeared in Area 2 in 2007. The CCC was shown a series of these cracks across a cleared power line easement. This chap actually fell into one of these on the day, luckily only up to his armpits as the cracks were said to go down 15 metres. What we found was that BHP was often not – not giving us the full picture. Does that sound familiar? So we arranged separate independent inspections with the SCA. On this one we discovered massive cracks up to a metre wide and continuing into the bushland across the landscape.

Our concern was, and remains, that not only could the people fall down these cracks but they acted as huge pitfall traps for – for animals. And here by – here was a nearby active wombat burrow. This issue was not considered to require any monitoring. In fact, there had not even been any fauna surveying prior to the mining. Also, there was no requirement to fill in these cracks except on fire trails. And you also see this sort of thing where rock outcrops can just split apart like this one in Area 3A in 2010. Cliff falls. It's stated there are 40 cliffs in Area 5 that will be directly undermined and another 46 within the angle of draw which means they are likely to be impacted. That's a lot of cliff lines that will most likely be destabilised like this one that we saw in Area 1 in 2008.

This massive rockfall was not even reported by BHP monitoring. We discovered it with the SCA on an independent inspection, and subsequently 10 others were found that also had gone unreported. There's massive, massive lumps of rock cascading down – tumbling down into the valley. This shows a rockfall in Area 3A in 2013, at a point below Swamp 12, where there was once a significant waterfall. Now, however, not only is the water gone, but the rock structure is ruined. What are the commitments to protecting key stream features in Areas 5 and 6.

A waterfall of this size will warrant protection by the longwall stopping short of the feature and starting again on the other side of it. This, however, is a nonsense, as it only affords protection of the rocks. But the feeder swamps of all these streams would be undermined, and there will be no water flowing down the stream. Why protect a waterfall if you cut off the water supply. The same applies to larges pools that are claimed to be given protection. They will only hold water after rain, but not for any lengthy period during dry times without the steady inflows from the feeder swamps. Now, surface disturbance. The catchment special areas are rightly off limits to the general public. But mining companies, their consultants, and contractors have unrestricted access.

Underground mining involves a lot of surface activities that are not conducive to maintaining a pristine catchment. Now, many bore holes are drilled to test depth of

strata during the exploration phase, and also for ..... placement to monitor groundwater pre, during and post-mining. Here a large area has been cleared and will be rehabbed in time, hopefully. Vent shafts are a major construction project. This is Vent Shaft number 3, which required clearing of over 20 hectares to build roads, bring in powerlines, and then all the men and equipment to build an up pass and down cast shaft. This took many manhours over many months and generated lots of traffic in and our every day.

This will be repeated four times in Areas 5 and 6. Remediation. Now, you may have wondered why you weren't shown any remediation on your site visit. That's because, to my knowledge, there hasn't been any. I believe some remediation has been required to address damage on Creek W2C21, but I don't think that has even been carried out yet. So no remediation attempts anywhere after 15 years of mining damage. The only remediation attempts I can show you in the catchment are on Waratah Rivulet, and these have been very slow, very limited, very expensive, and for a result that is nothing like perfect. And there have been no attempts to remediate upland swamps in the southern coal field, even if that were possible.

Remediation is not a solution. The only solution is avoidance. Now, this is this injection of polyurethane that Stuart talked about before, into cracks which oozes out and leaves this disgusting, unsightly residue. You really wouldn't expect to see that in a natural area, but that's what you can see there. Also, the drilling of grout curtains, is a technique for increasing the water holding capacity of pools. Water New South Wales do not consider there has been anything like a 100 per cent successful. And just getting all the men and vehicles and equipment into these sites to carry out remediation, results in unsightly barren cleared areas, such as this on Waratah Rivulet.

This was beside a fire trail where – but most damaged areas are not so accessible. And all this work at Waratah Rivulet still did not solve the problem of the contaminated water, however, which remain like this the last time I saw it, and will, no doubt, be the case for Dendrobium as well. Now, in conclusion, I think you would agree that what I've shown you would be unacceptable in any area, let alone the pristine bushland of a drinking water catchment. Yet, what you are being asked to approve is to more of the same, and even worse, because of the unprecedented extent of seam to surface cracking that is predicted. These are impacts that if seen by the general public, even those whose job depend on this mine, I know would not be considered acceptable.

That these impacts are in a restricted area, means they are out of sight, out of mind. Even seeing these pictures is not enough to bring home the enormity of the damage being rort. You, the decision-makers, must see this damage for yourselves. I urge you to seek an inspection with Water New South Wales, the land managers, for an open unbiased view of what is really happening out there. Your decision to approve or consign yet another vast area to the status of a silent, desiccated wasteland, a trashed landscape, in perpetuity, and for what? It is unconscionable that short-term economic gains should be the driver for such wilful destruction, especially when

there are alternatives, which other speakers have pointed out. You have a huge responsibility. It's an unenviable task. I hope this presentation has helped you to see your way clear to making the right decision. Thank you.

MR O'CONNOR: Thank you, Julie, for taking the time to provide us with those graphic illustrations, as well as your presentation. Any questions?

MR HANN: No.

MR BEASLEY: No.

MR O'CONNOR: No. No questions. Thank you.

MR BEASLEY: The next speaker is Grant Webster. Mr Webster.

MR G. WEBSTER: Hello. How are you? Yes. So my background, firstly. I'm an amphibian biologist. I've worked extensively on the frogs of Australia and New South Wales, including some of the most threatened species in our home state here. One – one of those species is Littlejohn's frog, Litoria littlejohni, and that's the frog I will be speaking about today. So this is one species that the ecological report identified that there would be a significant impact, a likely significant impact on, if the proposal was to go ahead. And we've just seen in the previous presentation, some of the habitat of Litoria littlejohni. So they breed in those – those sort of first order, second order streams that drain from these upland wetlands.

So, basically, the impact assessment and offset packages proposed for Litoria littlejohni are insufficient and should – should I deem the proposal to be refused. And this – this sort of actually stems from a very recent taxonomic review on the species. So it was actually published in just October this year. A new paper – I've got a copy of it here – is titled, A New Species of Frog in the Litoria ewingii species group, Anura Pelodryadidae from south-eastern Australia. This is by Mike Mahony and a few other Australian researchers. So what this taxonomic provision actually did, was effectively change the distribution of Litoria littljohni.

So it's no longer what it was thought to be at the time that it was assessed. It was always considered to be a reasonably uncommon frog. But used to be thought to be quite widely distributed, occurring from about Newcastle South to sort of the East Gippsland in Victoria. And over that range, it comprised about 10 extant populations, which isn't many, you know. It's not – not a lot of populations. So what the situation now is, is that everything – all the frogs occurring from south of about Bowral are a new species, Litoria watsonia. Only Litoria littlejohni only occurs sort of north of Bowral. So Litoria littlejohni has gone down from about 10 populations to three. And, consequently, the species is much, much more endangered than what it was at the time that Niche assessed it for the proposal.

So, yes, this basically renders the assessment outdated and, in my opinion, invalid. And the paper by Mahony actually goes into a bit more detail about the extant

populations of the new Litoria littlejohni. So I mentioned we have three populations. I don't know if you only see this figure too well, but it's this sort of pink area here that I've sort of highlighted on this sort of map. I mean, I can provide these documents, if you would like. Yes. So we have three populations, right. So one of them is in the Blue Mountains, one of them is in the Watagan Mountains near Newcastle, and the other population is on the Woronora Plateau, which is the population of interest.

So they're extant populations, as in there are still frogs there. There was a fourth population of the new Litoria littlejohni, known from the Royal National Park. That one is already extinct. So it disappeared after the big bushfires, I think, in the mid-90s. And we know that this species is susceptible to bushfire. We know it's susceptible to ..... fungus, and a whole suite of other things, and especially the impacts to breeding habitat, which you get from these longwall mines. So ..... that I will go into, you know, the status of each one of these populations. So the Blue Mountains population is highly endangered, okay. It has gone down from plenty of records and observations in the 90s, down to virtually none.

There's may be two or three sites in the Blue Mountains where they still know this species is there. So it's effectively on the way out, from ongoing ..... fungus, climate change, and all sorts of other things. The Watagan's population, so that's – now we're left with two populations; Watagan's and Woronora. The Watagan's population is still, you know, hanging on, but there has been noted to be declines in it. And, then, the Woronora population is the only population regarded to be stable. So in the paper that we have, the only population of this species which is regarded to be stable, is now likely to be given a significant impact if this proposal goes ahead. So, yes, in my opinion, considering a significant impact to the only stable population of this endangered frog, this proposal should be refused. The offsets are not appropriate and the impacts are just too – too much of a risk. If we – if we lose this Woronora population of this frog, the whole thing could go extinct now. That's it. Thank you.

MR O'CONNOR: Thank you, Grant. Are you able to make a written submission so we get copies of those papers, etcetera.

MR WEBSTER: Yes, I can. Yes, I can. Yes.

MR O'CONNOR: It would be much appreciated. Any questions, John?

MR HANN: No.

MR O'CONNOR: Richard?

MR BEASLEY: Not from me, really. Thanks.

MR O'CONNOR: Thanks for taking the time for that presentation. That concludes this session. We will reconvene at 2.15 pm. Thank you.

ADJOURNED **[1.23 pm]**

RESUMED **[2.14 pm]**

MR O'CONNOR: Welcome back to the final session on the final day of the public hearing interest in the Dendrobium Mine extension project. We'll have out next speaker please.

MR BEASLEY: I think we have Mike Young again and Howard Reed from the Department of Planning Industry and Environment.

MR YOUNG: That's correct, Commissioners. So it's Mike Young here from the Department of Planning Industry and Environment, I'm accompanied by Howard Reed and also Steve O'Donoghue. And we've been asked to come back to respond to any residual questions or matters that the Commission would like to put the department at the end of these hearings.

MR O'CONNOR: I take it, Mike, you've had the opportunity to see some of the proceedings over the last few days. Is there any sort of general comment you'd like to make in response to some of those issues that've been raised?

MR YOUNG: Look, I think that – and my colleagues can chip in as well, but we obviously undertook a very extensive consultation process through the assessment of the application and obviously that was formal and informal. We, I guess, are not surprised by some of the issues raised and some of the concerns raised by both individuals and also organisations and we don't – we think that reflects, I suppose, the significance of this decision.

And the thing that we grappled with most in the assessment was that this is a project in a sensitive area with relatively significant residual impacts that can be addressed and offset to some extent but, nonetheless, still having residual impacts in the special areas of Sydney's drinking water catchment. But also, it's a project that will have both significant economic benefit not just for South32 but also dependent organisations and businesses in the Illawarra as well as obviously benefits for the State as a whole in terms of royalties and other matters.

In broad terms, I guess we see the extension project as precisely that, an extension into a new area, I suppose, although within an existing mining lease. And that the nature of the mining is very similar to that which has been occurring for the last 18 years or so under the existing approvals. Now, whilst that historical mining has had impacts on surface features and on water within the catchment area, I guess we see that the nature of the mining proposed would be really a continuation of both those benefits but also those impacts.

I guess the key changes that I would see from the department's point of view and from Government's point of view is that since the mine was first approved some 20 years ago, even though that was following a Commission of enquiry and even though that's been subject to adaptive management over time through the extraction plan process, as this project would, the recognition of the importance of protecting Sydney's drinking water catchment, you know, has become paramount both to the community and to the Government. And that's been reflected in State environmental planning policies that have been brought in since that time.

It's reflected in the establishment of Water New South Wales and its role as to manage and protect the catchment. And so I think the key thing here is that there's been a number of inquiries now by experts, starting with the Reynolds inquiry in the 1970s through to various other inquiries in 2008, the Southern Coalfields inquiry, and then most recently by the chief scientist for mining in the catchment. And none of those expert panels have recommended that mining be prohibited or prevented in those areas due to the impacts and that mining can and is able to proceed subject to appropriate mitigation management.

But importantly, I guess the point I'm making now is that the new thing that the Government sought to implement at – in accordance with the instructions from the Minister Stokes, the Minister for Planning and Public Spaces, is to introduce a clear offsetting regime for water not just for biodiversity and other matters that would apply to any other mine.

But particularly to create that process for the Dendrobium project and other mines in the catchment to ensure that there's, in the medium to long-term, there's a net gain to Sydney's drinking water supplies through the provision of significant funds from South32 to be used by the New South Wales Government, as how it indicated on Wednesday to be used for augmentation of supply and/or addressing losses within the system to – so that overall there's no net loss, in fact arguably a benefit to Sydney's drinking water catchment.

So I guess in summary, we've heard nothing significant new over the last couple of days. Unless there's any particular matters that Howard or Steve wanted to draw attention to, and I guess we feel confident that our – broadly speaking, our assessment and our recommendations address the key issues that have been raised. Howard or Steve, did you want to add anything to that?

MR H. REED: Mike, I would just add to that, that if the commission is – is intrigued by any particular point that's been made by any submitter over the last few days, whether they're agency or community, then the Department would – would seek to answer any questions that you might have about that.

MR S. O'DONOGHUE: I've got nothing to add, Mike.

MR YOUNG: Yes.

MR O'CONNOR: So, Mike, I might come back to you, if I can, because you've given me a good segue into the first question I wanted to ask when you talked about Minister Stokes' initiative with the water offsets, etcetera, not just the biodiversity offsets. When I asked you a question on – on day 1 about the sealing of the mine, etcetera, you pointed out that the various assessments, the groundwater assessments and that were undertaken didn't necessarily assume that the mine would be totally sealed. So when it comes to calculating those contributions that – that need to be paid to offset for water losses, if the mines not possible to seal or it isn't sealed in those assumption – basic assumption in those assessments, how – how do you get a definitive number when it relates to the water losses to be able to calculate the financial contribution. I'm just a bit confused. If the mine's sealed, I can see that surface water loses eventually stabilise and no further surface water losses, but if the mine's not sealed, then it just seems to go on ad infinitum. So could you just explain that to me, please.

MR YOUNG: I think the important thing there is that as I was saying, it's not a sort of a simple input/output model, in terms of the geology and the – where the water goes over time. Now, I'm not a hydrogeologist. I'm relying on advice, obviously, of – of experts and – and so forth, and this is a matter that, you know, the commission may well want to put to the – the mining panel. However, my understanding and the advice I've received is that because of the nature of the geology and the different levels in terms of RL of the adits versus where the workings are, that the evidence in the modelling and also born out by what's happening – been happening with re-pressurisation of the Hawkesbury sandstone geology elements within the rock strata, is that over time you get partial re-pressurisation of those aquifers, regardless of whether the mine is sealed or not.

And so the offset calculations have an initial upfront component that would be provided to government, plus then an annual calculation on updated modelling of water losses, and so it is sufficiently flexible that that can be based on actual water losses over time, but you are right in the sense of if – if the – the modelling or if – if the mine is unable to be sealed and there are – there's only partial re-pressurisation and ongoing losses within the catchment of some measure, then the calculations that we've – or that South32 has done to offset those measures are based on some assumptions of an end to that water loss, and – however, I would argue two things.

One is that this re-pressurisation issue or partial re-pressurisation issue would occur regardless, and, secondly, the modelling is based on 271 years of – of re-pressurisation duration, so to speak. So it's not something that would be for 10 years post mining or 20 years post mining. The calculations are based on what we expect to happen over the next, you know, almost 300 years. Now, one might argue that, well, South32 should be required to pay in perpetuity, but there needs to be a reasonable process and a reasonable figure that can be brought to bear in the planning process and decision-making process now such that a reasonable corporate entity can plan with some certainty and a particular package of offsets be accepted by government as a reasonable approach based on the facts. And so I think – well, I – I can – I can clarify that the government has accepted, based on the facts, that the

proposed offsetting package is reasonable and reasonably takes into account post-mining losses for, as I say, a considerable period of time after mining, and that the partial re-pressurisation of those Hawkesbury sandstone elements and the fact that the workings are well below the actual adits means that the water losses over time will diminish substantially.

Whether they ever get to nil if the mine can't be sealed, I guess, I'm not in a position to unequivocally provide advice today on that but could do so in writing or, as I've suggested, the mining panel may well be able to provide or South32. So, Howard, do you have any clarification on what I've just said?

MR REED: Yes, Mike. I do. If I can clarify. Going back to your question, Commissioner O'Connor. Where the water exits isn't really the relevant question. It's a question of what water continues to enter from the surface. So the question of whether or not the mine is sealed isn't particularly material. That's – that's material for many other issues but it's not particularly material in terms of assessing surface water losses. So, putting it another way, it's – it's more a question of whether the roof leaks rather than a question of whether the door is open. Okay? So in terms of leakiness in the roof the way the modelling works is that the roof will be leakiest initially. And then it will begin to become less leaky over time.

And the fundamental reason for that is that the geological strata begin to settle and compact and so there's less transmission of surface water through to the mine. Re-pressurisation is a different question. So that's really water coming up from the mine or water coming up from any particular aquitard that – that is – that is present or that re-establishes in – in that roof strata over time. But Mike – Mike is quite right in saying that there will be re-pressurisation over time, partly as those strata settle and become more compact, and also, in addition, from water that – that begins to fill the mine and then to – to elevate up through the strata.

So the fundamental question is how much water is going to come into the mine and that's what's particularly relevant for the calculation for the offset value. So Mike talked about 271 years. The – the company's groundwater modelling is for 102 years. That takes us out to 2150 and later modelling that's been done has added another 171 years to that. And I must stress that that's not for the purpose of allowing the surface water ingress to reduce to zero. It's a financial model. It's – it's – it's in order to – to derive the date at which the value, the additional value, of each payment per annum in today's dollars discounted reduces to next to zero.

So my understanding – and I could be wrong on this but I believe I'm correct – is that the surface – the water modelling of ingress goes out to 2150. 102 years. And then the same figure – that same amount of water ingress has been stretched out another 171 years without diminution of the amount of water coming into the mine and because the purpose of it – it's a financial model rather than a water loss model. So even if the water ingress remained as high as it was in 2150 for another 171 years then the government would be fully compensated for that water loss.

MR YOUNG: The other thing I would just quickly add, and I'm sure we're taking a long time to answer, but it is a complex question, so apologies – but my understanding, as well, is that that assumes a level of surface to seam cracking that – that evidence might suggest from both the geology and the depth of cover and so forth is unlikely to be uniform or occur across the entire site. So that you would actually – as you say, you may get some losses of surface water but they may well report back to the catchment as opposed to the mine workings, in reality.

MR O'CONNOR: Yes. I – I understand that point.

MR YOUNG: So it's a conservative approach to calculation in addition. Yes.

MR O'CONNOR: No, I understand - - -

MR YOUNG: So hopefully that makes sense.

MR O'CONNOR: - - - the safety factors that have been built into those calculations. Just a second question and it might – might be Howard or yourself, Mike, relates to just how has climate change been factored into the assessment that you've undertaken. And I'm not just focused on water losses and the importance of water. I'm thinking of fire history as well. Just the resilience of those ecosystems over time. Can you just tell me how that's been considered in preparing your report.

MR YOUNG: I will let – I will let Howard answer that one.

MR REED: Well, I think the first place to start is with the IPART determinations. So I believe that additional advice that Mike promised in our earlier conversation - - -

MR YOUNG: I believe that's been provided to the Commission today, Howard.

MR REED: That's – that's what I'm saying. That it's – that it's going – that it's gone to the Commission today so that – that advice addresses your question in detail, I believe. But in summary, it's – it's modelling that IPART uses is WaterNSW modelling of what future drought scenarios will be. So there's a – a general acceptance between WaterNSW and IPART on the one drought year in 10 provision. And that's not actually a reflection of climatic scenarios. It's a reflection of what the – how – how full the dams are expected to be. So the drought scenario is based on the dams being – in total, being less than 50 per cent full. And the current modelling from WaterNSW, as accepted by IPART, is that that will be one year in 10.

MR YOUNG: What about more broadly, Howard, in terms of – I think Commissioner O'Connor was talking about, you know, general in terms of impacts, bushfire regimes, impacts on ecology, those sorts of things. Not just water.

MR REED: Well, to a very considerable degree we've had to rely on the modelling assessments and the baseline assessments that have been put forward by the company and that have otherwise been put forward by different agencies. The – the – the

stand out characteristic of climate around the Woronora-Illawarra Plateau is the existence of the escarpment. And what that means is that onshore winds from the Tasman Sea rise up steeply against that escarpment which is close to a couple of thousand feet high. And that means that rain is dumped just over the top of the escarpment and sometimes on Wollongong itself. But it's very regular, quite heavy falls of rain in that area because of onshore winds out of the Tasman.

And that's the fundamental reason why those swamps exist. Because of the rainfall that is dumped just over the top of the escarpment. And I know of no modelling that suggests that that rainfall pattern is in danger. Even in danger of diminution. And, if you like, additional heavy storms in that area are – are not outside the norm. There are already many heavy storms in that area and very regular rainfall. What's of more concern is extended droughts, but, again, I know of no modelling that suggests that that part of the world and the ecosystems there are at any greater threat than anywhere else in NSW.

MR O'CONNOR: And was that factored into your assessment? Those climate change scenarios?

MR REED: Well, there were – no information has been put forward during the assessment that would suggest that climate change will be a key source of stress on the environment that would be exacerbated by mining. The discussion from go to woe, really, has been about the impacts of mining on background, regardless of what the background is.

MR O'CONNOR: Thank you for those responses. I might hand over to John now for some questions.

MR HANN: Mr Reed, just really following up on that last conversation, we were presented earlier at the hearing with some evidence of comparative work recently after the bushfires in December, January upon the Newnes plateau comparing mined areas under swamps versus non-mined and the response to bushfires. I don't know whether you saw that, but you might like to add to your last commentary on those conclusions because that seemed to suggest that the – the mining underground there did have some impact in relation to bushfires.

MR REED: And I think that – that information is fair enough. What – what appears to be missing from that information is a bit more contextualisation about the environments in – in and around the Springvale as against the Woronora Plateau, and so on. My understanding is that most, if not all the swamps, around Springvale are valley infill swamps, and they're all associated with very significant lineaments – what's called a lineament, which might be a fault or another crack in the surface of the earth that – that extends all the way to the surface. So what you have there is an environment where there are significant cracks that – and on top of them you've got peat-filled swamps, and so the cracks, particularly where – well, they're subject to some reactivation by mining settlements and so some of the impacts of mining in and around the Springvale area have been a little bit surprising.

They've been more extensive and at a further distance than was predicted, reflecting, if you like, the local geology, and once those cracks are reactivated, then the swamps can become very dry very quickly. They drain – drain through the floor, and because they're high in peat, they're subject to burning out. But in the Southern Coalfield, the situation is a bit different. There's much less evidence – in fact, I'm not aware of any evidence that – that correlates the swamp environments there with those at Springvale. Many lineaments don't go through to the surface. Those that do don't seem to be as leaky as the ones at Springvale and – and the mines nearby.

And – and many of the swamps at Dendrobium and thereabouts are either what are called headwater swamps or they're hybrid swamps where there's a large headwater component and a smaller valley infill component. And the bottom line from that is that the sedimentary base in those two different kinds of swamps varies quite a bit. So it's only in some of the valley infill swamps that there won't be a lot of crustal settlement, and there will be high proportions of peat. So that's an occasional occurrence there rather than a – a regular occurrence.

There is a swamp at Metropolitan that eroded out, scoured out, because it was that kind of swamp, it was a valley infill swamp that had a lot of peat in it. But there aren't many examples in the Southern Coalfield where that has been the case, and I understand – this is my own understanding, but I've had it reflected by other people, that one of the fundamental reasons for that is that a greater proportion of the swamps in the Southern Coalfield have that sandy, crustal sedimentary base, thin skin of – of – of sediment sitting on top of a solid bedrock. So as the report says, those swamps are more categorised by regular water logging, rather than continual water logging.

That's why other – other flora don't grow because seeds die with the regular water logging from the climate that I referred to before. And so, fundamentally, that – that means that swamps in the Southern Coalfield are less likely to burn out than those up around the Springvale mine. So very interesting results there. Very good paper. But not directly referable to the situation at Dendrobium.

MR HANN: Thanks, Mr Reid. Thanks for clarifying. Just following up from my colleague – just in relation to funding and we've talked about water and this – this goes a little bit further. The recommendation number 8 from the – from the Independent Advisory Panel on underground mining seeks guarantees of adequate funding. And so while this would cover both mine closure itself and then after the mine closure, obviously, it's intended to – to cover both the water inflow and so on. But would you be able to explain the – a guarantee of adequate funding in terms of the conditions that would also cover the maintenance, the remediation that may be required on the stream features but, also, ongoing maintenance that may be required on the – on the mine ceiling?

MR REID: Sure, Mr Hann. The report draws attention to the existing provisions in the Mining Act in – in this regard and I believe it's for that reason that the mining panel's recommendation was expressed in terms of government rather than the

Department in the recognition that not all responsibilities for regulation of mines reside under the EP&A Act or – or are best dealt with via development consent. The practice of the Department is taken over many years as being to respect the – the role of the resources regulator and – and minerals, energy and geoscience group and the coverage of the Mining Act. The Mining Act had at one stage the pre-eminent provisions across the country in respect of security deposits and they – and those security deposits are in respect of all requirements under the Mining Act including all responsibilities within a mining lease in respect of rehabilitation.

And the way things have worked for many years is that the Department's requirements for rehabilitation have been reflected in plans that also have a life under the Mining Act. So what has been a rehabilitation management plan for us becomes a mining operations plan for – for Meg and the resources regulator, and I think it's fair to say that the Department's proposed conditions and the comments in the assessment report reflect the confidence that the Department has that its requirements in respect of rehabilitation. Whether it's under the rehab management plan or elsewhere in the consent and likewise in regard to mine closure that they would all be fully reflected within a revision to the company's security deposit under the Mining Act.

MR YOUNG: And how – would that pertain also remediation of – of streams and service features not - - -

MR REID: Insofar – insofar as it wasn't done by the company. So there's the expectation that that will be done by the company. The security deposit is a failsafe. The responsibility always rests with the company to rehabilitate whether it's under the Mining Act or under a consent. The security deposit is meant to be a failsafe that comes into effect in the "what if" circumstance where the company for whatever reason fails to remediate.

MR YOUNG: And I would note in regard to the water loss issue that the upfront payment in particular is to capture the post-mining aspects of water losses and then an annual payment during the life of the mine so that there's no – in other words, where – where front loading the post-mining scenario at the beginning of mining and then each year as mining progresses South32 would be required under the planning approval to – to make those relevant payments based on calculated water losses.

MR REID: And to make a payment that reflected actual losses.

MR YOUNG: Actual losses.

MR REID: Yes.

MR YOUNG: That's right.

MR HANN: So – Mr Young, so what you're saying is so in appendix 5 the 16 million or so is the upfront payment post the mining?

MR REID: Yes.

MR YOUNG: Correct. We've front loaded that and - - -

MR HANN: Yes.

MR YOUNG: - - - and that's based on that kind of 271 years that we were talking about before and front loading that and then paying subsequent progressive payments each year based on actual water losses.

MR HANN: Okay. No, thanks. And thanks, Mr Reid. So what you're saying is it's the resource regulator under the Mining Act that will set appropriate security deposits in terms of, as you say, the failsafe mechanism should the - - -

MR REID: In a nutshell, yes.

MR HANN: Yes. No. Okay. Thank you. Look, I have another question that relates to, in this case, subsidence and the impacts on streams. In condition – and this goes to the conditions you're proposing – condition C1 which is table 8. It talks about no subsidence greater than what's predicted in the EIS. So that obviously puts a lot of weight on the – the environmental impact assessment. However, I – I note that in the Independent Advisory Panel's conclusions on this they – their – they state that the assessment of the impacts on streams is not adequate and they – they go onto say that there wasn't a proper identification of the likelihood and consequences that relate to risks. So given that that goes to the – the impact assessment would you like to make a comment about that?

MR REID: Sure. I think that this relates to the third recommendation of the mining panel and I think there may be some value in reading that out if I may?

UNIDENTIFIED MALE: Go ahead, Howard.

MR HANN: Please.

MR REID: So

> *The adoption of a risk assessment approach for evaluating the nature and scale of environmental impacts, the appropriateness of the limit selected for environmental impacts, the reliability of setback distances of ..... proposed for preventing these limits being exceeded and the suitability of the mine layout to adapt in management as a control for preventing exceedances of predicted impacts.*

Is that the recommendation you're referring to, Mr Hann, or is it the fifth one?

MR HANN: No, I'm – I'm not referring to that. The recommendation was in my earlier question. That was recommendation 8 that related to funding. This relates to

some earlier statements in the – in the – I don't have them in front of me but it's not one of the recommendations. But it relates to – there is – the risk assessment and they conducted their own risk assessment as a sample, if you like, and then concluded that from the work that they could see that was done, strictly speaking, it wasn't a proper risk assessment because they weren't about to identify the likelihood nor the consequences particularly of the stream features. And so because this goes to the – the assessment itself then condition C1 really relies very much on a robust environmental impact assessment and so in the content of the comprehensive report of the Independent Advisory Panel there seems to be some question marks about that assessment.

MR REID: Okay. I understand. If you will allow me I will refer to both those recommendations as I respond to you – the third one and the fifth one – because the third one is about risk assessment and the fifth one is about more specific performance measures. So I think that it, sort of, book ends your – your question. In terms of risk assessment it's a – it's a complex area. The way I understand the mining panel's recommendation in a nutshell is that the wanted more specified assessment of consequence and likelihood for a series of values across the – across the site and the likelihood of impact and the consequence of impact. And the way that's normally expressed is a nice series of matrices that have high and extreme and moderate and so on risk. And you – I have to agree that that would be a very neat way for a company to present its starter, in summary, and a very straightforward way for the Department to assess it. But in the end those comments were really about the methodology of risk assessment, and I think, on that level, they're very valid, but it wasn't actually a criticism of the outcomes of the risk assessment, so neither the mining panel nor any of the agencies said, "We don't like the different valuations that have been given to streams", or, "We don't like the valuation that has been given to key aquatic habitat – key fish habitat", I should say. And there are other methodological questions about, well, surely there are different ways to assess stream significance or to identify key stream features, but no one came forward with a different and better basis to assess the significance of those different features, and, in many senses, the significance of those features is a surrogate or an analogue for the consequence of their loss.

So, in many respects, the consequences of loss were addressed within the EIS and its related documents, but they just weren't addressed in terms of a risk assessment consequence likelihood matrix, which is the traditional way to summarise and put forward that information. So, in the end, the way the assessment report treated this recommendation was to endorse it as an approach, but we had two – well, we had two choices to take, then: we could say to South32, "Well, the mining panel thinks your risk assessment methodology can be improved; therefore, we will kick the project back to you. Please present a revised series of risk assessment matrices." Or else we could consider whether we could determine the project based on the information that was provided to date, notwithstanding that methodological difference, and that was the position that the department came to: that there was sufficient information there about the consequences of loss of a variety of different values across the site and the likelihood of impacts.

There were many likelihoods that were put forward in terms of percentages rather than a traditional risk assessment matrix, which doesn't go much beyond, "Well, I think it's a five-band split", but there were percentage likelihoods put forward down to five and seven per cent, and so there was quite a deal of information there about likelihood as well. So, on the basis of the information that was there, the department decided that it had enough information to recommend determination of the project, and no one to my knowledge, with the possible exception of third-order streams, which we could come to if you wished, no one has really put forward a position that says the consequences of the impacts as now understood and as outlined in the project are beyond the pale and we have to change the consequence outcomes. So, on that basis, I should turn, if I can – unless you want to ask a question – to the performance measures themselves.

MR BEASLEY: Well, I think I will go to that, and it's simply this: that, given that condition (c)(1) says no subsidence greater than predicted in the EIS, what if there is subsidence greater than is predicted in the EIS? What's the outcome from a - - -

MR REED: Well, that leads either to remediation or further offsets. So condition (c)(2) provides for additional offsets if those impacts can't be remediated. So the performance measures are not – they're not simply what the company put forward. We've toughened up the performance measures in three respects that I can think of. So, first of all, there's not greater than negligible impacts on the Avon River and the Cordeaux River. That was tougher than the company proposed. Secondly, we've proposed a remediation for impacts on third-order water courses, and I believe the third one is that the company clarified its original intentions to remediate key stream features where practicable to a much, I think, tougher standard, of where the environment impacts of remediation were less than the environmental impacts that were being remediated.

So we haven't simply reflected what was in the EIS, but, where we thought the EIS had hit the right target, then, yes, we reflected the EIS as being the appropriate standard. It's a fairly standard practice of the department to reflect what's in the EIS, which – there's another condition that says the company has to be in general accordance with it in any case, but, where the company hits the right standard, we often reflect it in that way. Sometimes, we reinforce it in our own language, but it's really where we think the standards ought to be improved or increased; that's where we focus in the performance measures.

MR YOUNG: I would add to that the commissioner's – thank you, Howard. It's Mike Young here. I would add to that that overarching all of that is a couple of key things. One is obviously an enforcement and compliance regime under the Act, and obviously, you know, the department has certain powers given to it under the legislation to enforce the relevant aspects of the consent, but, as Howard has indicated, there's remediation and/or offsetting. But, in addition to that – and this has certainly been borne out in the processes through adaptive management at a number of mining projects, underground – including the Dendrobium existing operations – is through the extraction-plan process, and so that, if impacts are

occurring that are unexpected, unforeseen, greater than the relevance performance measures, whilst you can't put the genie back in the bottle necessarily straight away on a particular impact, but what you can do is influence quite quickly either the continuing extraction of the long wall in question or indeed future longwalls through the extraction-plan process.

And so there has been many instances under that process under the existing operations where long walls have been either shortened, greater setbacks imposed, regimes to demonstrate certain performance outcomes before certain thresholds are passed, and also, in some instances, narrowing of long walls, particularly at the metropolitan mine. So there are levers that the department has that are very substantial that can affect or substantially address any unforeseen impact, so it's not a set-and-forget type of situation.

MR BEASLEY: Thanks, Mr Young, and thank you very much, Mr Reed.

MR O'CONNOR: That last comment, Mike – I guess that embodies the adaptive management approach the department adopts that you've just explained. Thank you.

MR YOUNG: That's correct. Yes.

MR O'CONNOR: Richard, do you have any questions? Look, I think that takes care of our questions. Thank you to the department for allowing their officers to come along and answer our questions this afternoon, and thanks for your time. That brings us to the end of this electronic public hearing into the Dendrobium mine extension project. Thank you to everyone who has participated in this important process. John Hann and I have really appreciated your input. Just a reminder that it's not too late to have your say in relation to this proposal. Simply click on the "have your say" portal on the IPC website or send a submission via email or post. The deadline for written submissions is 5 pm on Tuesday, 15 December 2020.

In the interests of openness and transparency, we will be making a full transcript of this public hearing available on our website in the next few days. At the time of determination of this application, the commission will publish its statement of reasons for decision, which will outline how the panel took the community's views into consideration as part of our decision making process. Finally, a quick thank you to my fellow commissioner, John Hann, and also to our counsel assisting, Richard Beasley SC. I would also like to acknowledge the behind-the-scenes support we've had from the staff from the Independent Planning Commission office and from the technical production team here in the studio. Thank you for watching. From all of us at the commission, enjoy the rest of your day. Goodbye.

ADJOURNED **[2.59 pm]**