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TRANSCRIPT OF PROCEEDINGS

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INDEPENDENT PLANNING COMMISSION

MEETING WITH APPLICANT

RE: VICKERY EXTENSION PROJECT

PANEL:	**JOHN HANN** **PROF CHRIS FELL** **PROF GARRY WILLGOOSE**
ASSISTING PANEL:	**DAVID WAY** **DIANE MITCHELL**
APPLICANT:	**MICHAEL VAN MAANEN** **BRIAN COLE** **DR NOEL MERRICK** **GREG ROADS** **CHRIS THOMAS** **JOHN WASSERMAN** **DR STEPHEN BEARE** **ALEKS TODOROSKI** **JOSH HUNT**
LOCATION:	**IPC OFFICE** **LEVEL 3, 201 ELIZABETH STREET** **SYDNEY, NEW SOUTH WALES**
DATE:	**9.26 AM, MONDAY, 25 FEBRUARY 2019**

MR J. HANN: Well, we might kick off if we're all settled. I've just got a short procedure, not as long as the one at the public hearing a few weeks ago. So look, if you wouldn't mind just bearing with me. Good morning and welcome. Before we being, I'd like to acknowledge the traditional owners of the land on which we meet and pay my respects to their elders, past and present.

So welcome to the meeting today. Whitehaven Coal Limited, the applicant, is proposing to develop the Vickery Extension Project, an open cut coal mine near Boggabri, New South Wales. My name is John Hann. I'm the chair of this IPC panel, and joining me are Professor Chris Fell and Professor Garry Willgoose.

I'd like to invite the other attendees of the meeting now, if you wouldn't mind, just to introduce yourselves for the record but also during the course of the meeting when you speak, if you wouldn't mind just giving your name again. It's simply so we get it right in the transcript. So perhaps Brian - - -

MR B. COLE: Yes. Brian Cole, executive general manager, project delivery, Whitehaven.

MR M. VAN MAANEN: Michael van Maanen, executive general manager of Corporate and External Affairs, Whitehaven Coal.

MR J. HUNT: Josh Hunt, principal of Resource Strategies.

MR N. MERRICK: Noel Merrick, hydro-simulations, hydrogeologist.

MR G. ROADS: Greg Roads, WRM, flooding continuum.

MR A. TODOROSKI: Aleks Todoroski, air quality.

MR J. WASSERMAN: John Wasserman from Wilkinson Murray, acoustics.

MR C. THOMAS: Chris Thomas, practice lead, Water Resources from Advisian, water classes group.

DR S. BEARE: Stephen Beare from ANALYTECON .....

MR HANN: That okay, Finlay? Got that. Thanks. Thanks very much. So in the interests of openness and transparency and to ensure the full capture of information, today's meeting is being recorded and a full transcript will be produced and made available on the commission's website. So this meeting is one part of the commission's process. It's taking place after the initial public hearings and will form one of several sources of information upon which the commission will base its final issues report. It is important for the commissioners to ask questions of attendees and clarify issues whenever we consider it appropriate.

If you're asked a question and are not in a position to answer, please feel free to take the question on notice and any additional information in writing – and provide any additional information in writing to us which we will then put up on our website. So we'll now proceed with the meeting proper. What we're putting together is an issues report and so what we're wanting to understand is that we've got a proper and clear position on what you've presented and whether we feel there are any gaps or whether we feel that there is additional material that would be of benefit for further steps in the process.

So it's not a review, as I think you all understand, but for us our terms of reference are to put together an issues report. So the questions, if you like, that we want to put to you this morning relate to giving us a better understanding of what the issues are that we think are key. And also to identify any gaps that we think are there that we would then clearly elaborate on in our issues report. So if I can hand over, probably, to Garry first to kick off.

MR VAN MAANEN: Could I – Chair, is it okay if I just make some very brief introductory remarks?

MR HANN: Absolutely.

MR VAN MAANEN: It's just - - -

MR HANN: If that suits, of course.

MR VAN MAANEN: Yes. Really, just very high level - - -

MR HANN: No problem.

MR VAN MAANEN: Just to say thank you, once again, for all your time today and I know the meeting has shifted around a bit and the IPC has been very accommodating in that regard so we appreciate that. On behalf of Paul Flynn, the chief executive officer of the company, can I just send his apologies. With the meeting moving around, it unfortunately just clashed with the requirement for him to be in Miami for what is one of the largest mining and metals conferences globally so he's unable to be here today but as you can see, we have a sizeable team of experts present who I'm sure you are looking forward to talking to.

Can I just also place on record Whitehaven Coal's appreciation for the way in which the public hearings, in both Boggabri and Gunnedah, were conducted. Community consultation is absolutely integral to the process and certainly integral as far as the company is concerned and certainly those wishing to make representations to the panel were afforded, you know, full opportunity to do that. There was plenty of meaningful feedback and, as a proponent, it was great to see lots of support from the community, from residents, farmers, business owners, indigenous leaders, commercial partners, employees and others, and it's pleasing to see that the support that we do know exists in the local community being expressed in that way.

So whether it's at the hearings or in the submissions to DPE, which as you'd be aware over 60 per cent were positive and all the submissions to the IPC so far, which I think about 80 per cent were positive, you know, it's good that the project has got support across a wide cross-section, in our view, and this is, you know, just to restate that this is a critical project for this company and it's a critical project for quite a number of the stakeholders that you would have already heard from and we think it's a critical project for New South Wales and for further – you know, the economic contribution that it will make to the state. I think that's probably it from me in terms of introductory remarks so I'll hand back to you, Chair, having said that.

MR HANN: All right. No, thank you. Thank you, Michael. What I didn't do is introduce David Way and Dianna Mitchell, who are supporting the Vickery case from the secretariat so they're supporting the process.

MR D. WAY: Yes. Right.

MR HANN: So apologies for that. So on that basis then, if we can kick off with - - -

PROF WILLGOOSE: So you're happy for me to start talking about the groundwater side - - -

MR HANN: Yes. Yes.

PROF WILLGOOSE: Okay.

MR HANN: Let's - - -

MR VAN MAANEN: Just - - -

MR HANN: Sorry?

MR HUNT: Sorry to interrupt again.

MR HANN: No, that's okay.

MR HUNT: So – sorry. Josh Hunt. The way we've prepared for today was to take the questions which David Way provided with us - - -

MR HANN: Okay.

MR HUNT: - - - which come from the commission and each expert has prepared a one-slide response to each of the questions that were raised - - -

MR HANN: All right.

MR HUNT: - - - including graphs or figures or supporting material. So our intent was to go through those - - -

PROF WILLGOOSE: Yes.

MR HUNT: - - - and then, of course, that would lead to additional questions as you see fit.

PROF WILLGOOSE: Yes.

MR HUNT: Yes. And - - -

MR HANN: Look, that's fine. Yes. If you're happy with that, Garry - - -

PROF WILLGOOSE: Yes. I'm happy with that. Yes. Yes.

MR HANN: Yes – no. Thanks for doing that.

MR HUNT: And also, there's some repetition of the original presentations that the experts made when we met here on the first occasion, just because of the change in the commission members. So - - -

MR HANN: Well, of course, because obviously - - -

MR HUNT: Yes.

MR HANN: - - - while we've – Chris and I have read the transcripts - - -

MR HUNT: Yes.

MR HANN: - - - we appreciate if you think that there's anything that we may have not picked up on by reading those transcripts, now's a good time – today's the opportunity to make sure Chris and I are aware of those.

MR HUNT: Thank you. We appreciate that. Yes.

MR COLE: Okay. Well, look, I'll step through the – I guess the Whitehaven aspects of the presentation.

MR VAN MAANEN: Do you want me to - - -

MR HANN: You can just use the arrow keys.

MR VAN MAANEN: Just use the arrows.

MR COLE: Okay. There we go.

MR VAN MAANEN: Just use this thing here, Brian.

MR COLE: As Josh indicated, the format of the presentation is that I'll quickly just go through an overview of the project. I don't want to repeat what we've done before but just a little bit of the higher levels material. I will then address some of the questions that I guess fall into the domain of Whitehaven and then we'll go into the individual presentations from the various specialists and they will address the specific questions that came through to us. So in terms of the project justification, as you're aware, primarily the project is about coking coal. That's where the majority of the coal will be eventually used as well as that it's high quality thermal but 60 to 70 per cent of it can be used for coking coal.

We've increased the output from 4.5 up to 10 and what that's allowed us to do is provide for more efficient extraction of the resource. It provides the justification for investing in a coal handling plant on site and a rail spur solution to the transport aspects of the project. Of course, the cessation of coal transport on public roads ends up being a major benefit of the project and ultimately, the Gunnedah CHPP can be decommissioned. Now, we see those as significant benefits to the community. The site's a former mining precinct known to contain highly sought after coal. When compared with the approved mine, open cut mining is no closer to the Namoi. The western placement is no close to the Namoi. There is no significant change in the predicted amenity and dust impacts from mining operations and of course the number of final voids is reduced from two to one. You're now familiar with the size. I won't go through that again.

PROF FELL: Excuse me. Just on a general side, the coal when it's sold, is it likely to go to a country that is a signatory to the Paris Accord on greenhouse - - -

MR COLE: Yes, yes.

PROF FELL: Thank you.

MR COLE: Most of our coal would go to Japan and Korea and Taiwan.

PROF FELL: Sure. That's all. Thank you.

MR COLE: So you've seen the site. The number of voids that are there – I won't go back over that again. And, of course, the extension project – it builds on the – it builds on the approval. So the yellow marked sections are basically what the extension is about. It was really triggered because Whitehaven acquired the Vickery South deposit and it provided the opportunity to go back and revisit the approved project again. As Mike has indicated, we've done extensive community consultation during the lead up to the project. It involves face-to-face meetings with local businesses and, you know, local landholders, community information sessions.

I think you will find that the degree of input that you saw at both the two days at Gunnedah and Boggabri and also the follow-up that has come to the commission

from people interested in the project indicates that there is a lot of support out there in the community for the project to proceed. I've mentioned the rail spur. It's a key benefit of the project because it takes away road transport on that section of the public roads. It's located primarily on Whitehaven land or where we have access agreements in place.

The alternative rail corridor was considered – included one to the north and I will cover this in more detail later, but in general terms – and it's covered in the EIS documentation that a range of issues arose with connecting to the Boggabri-Maules Creek rail spur which made it not feasible and significantly less economic, including congestion of the common section of the rail spur, disturbance of an existing biodiversity offset area, increased train movements through the town of Boggabri and increased travel distance between the mine and the port and also there would have been additional trains that would pass through the town of Boggabri.

Of course we needed to design the rail spur to avoid flood impacts and that's exactly what we've done. Greg Roads will cover that in more detail in his presentation, but it's similar to the Maules Creek rail spur. We took you up and showed you that when we were there, although it will not for obvious reasons – because the floodplain is different there, it won't be as high. It's located on property boundaries to minimise disruption to existing agricultural enterprises. The closest existing dwellings between five and 750 metres are located on one property with all other dwellings located more than 800 metres from the rail spur. Compliance with the relevant noise criteria for private rail spurs is predicted at all existing private dwellings, and of course it's designed to comply with the Namoi Floodplain Management Plan.

In terms of the final landform, we've produced an improved final landform compared with the approved mine, including a major reductions in the number of voids – final voids – compared with the approved mine which has two final voids of 490 hectares, the extension project final void is 250 hectares. Modelling confirms the final void would act as a groundwater sink and this will be discussed by Dr Merrick when he gives his presentation. TPE states the proposed final void appears to be a considerable improvement on the approved final landform in terms of the number and catchment area of the voids and the long-term groundwater inflows.

Microrelief incorporated into the landform design to assist the developing – development of a stable landform and it will be progressively rehabilitated to native vegetation and areas suitable for agriculture. Height of the overburden dump is less than the height of the ridgeline in the Vickery State Forest. What I will now move on to are those comments or questions or points of interest that were provided to us on behalf of the commission. The first one says "details of the assessment of all rail options and particularly the northern loop providing the assumptions and specific reasons for conclusions". The response is Whitehaven considered a number of options for the rail spur and in particular the project rail spur is presented in the EIS and the northern rail spur.

In assessing the options, a number of factors had to be considered which included, obviously, land ownership, construction, comparative lengths, water course locations, road crossings, upgrades to existing infrastructure, logistics and congestion, capacity of the existing Maules Creek rail spur, cycle times and the requirement for a new passing lops. Environmentally it was to do with floodplain management, the Boggabri offsets, biodiversity and Aboriginal heritage, and of course relative cost – the relative capital cost, operational costs of – and as well as that, you've got the above and below rail costs as well. An economic analysis of the two options indicated that the rail spur options proposed delivered – the option proposed delivered in excess of 150 million in value when compared with the northern option.

The next issue raised was:

> *More explicit arguments need to be provided re the infeasibility of the northern route, for example, the 2014 EIS indicates that Tarrawonga was to share the Boggabri mine loading facilities, but no commercial agreement could be reached suggesting that the route can technically carry more coal than its current usage. Are there engineering issues or economic or something else?*

The common section of the Boggabri rail spur has 16 participants in it. Given that Maules Creek has three participants in its joint venture and the – likewise for the Boggabri Mine. When the original joint venture was formed, the capacity of the rail spur was stated to be 28 million tonnes per annum. The Maules Creek Mine has an approved rail output of 12.5 million tonnes per annum. Boggabri Coal has an approved rail output of 10 million tonnes per annum. Therefore currently allocated is 22.4 million tonnes per annum. The spare capacity must be shared between each of the six participants.

Railings from the project – from the Vickery Extension Project would be 11.5 million tonnes per annum, as per the EIS. So the capacity increase would therefore necessitate significant improvements in infrastructure, for instance new passing loops. It could include a floodplain crossing because of the topography along the common section of that rail spur or new above rail plant. So that basically is the reason why we've gone for what we call the south-western spur. The specific timing of the rail commissioning – specific timing is obviously dependent on when the project is approved and therefore construction can commence.

We expect the construction period to first railing to be approximately 12 months, as indicated in the EIS. Full commissioning which would involve destressing, signalling, defect rectification would be approximately another six months. Specific timing of the CHPP commissioning – obviously, again, the specific timing is dependent on when the project gets moving. The construction period would be approximately 12 months. It assumes that long lead-time equipment is ordered in advance and commissioning of the plant once you get it up and running usually takes about another six to nine months to actually get the washing part of the plant tuned.

Details of the assessment of all options and assumptions for the location of the CHP and reasons for the proposed positioning. The location of the CHP relates to, primarily, the rail spur location. The proposed rail spur approaches from the southwest which lends itself to a similar location to the CHPP. The location needs to be, obviously, clear of the flood zone. An alternative location was to the northwest of the mine. It would have impacted to a greater extent on the existing vegetation and it would have also required to traverse the full western boundary of the mine and for those reasons, the CHPP is located where it is proposed at the moment.

MR HANN: Brian, can I just interrupt for a minute. In the approved mine, you've got infrastructure to the southeast of the current project. Was that also factored in your assessment of alternatives for the rail loop and therefore the CHPP in the southeast?

MR COLE: It was. We did look at that. The flooding of those ephemeral streams in that area and the space considerations, bearing in mind that for the approved mine, processing was just a crushing plant, not a full CHPP.

MR HANN: Indeed. Understood.

MR COLE: So when we looked at it – when we looked at the location of a rail loop – your rail loop has to be, basically, adjacent to the CHPP – that particular location, to us, came out as being the preferable one.

MR HANN: And the key reason is flooding in terms of the – given what you're saying is the CHPP plant really is driven off where you can put the rail loop.

MR COLE: Yes.

MR HANN: You're talking about for the extension and the volumes involved - - -

MR COLE: Yes, yes.

MR HANN: - - - so it's a rail loop and where it can be positioned, if you like, and flooding is the key reason why you couldn't bring it into what would be the southeast of the project?

MR COLE: Yes, yes. Those ephemeral streams through there do – and you will note that as it is there's some requirement for bunding through that area, so we couldn't easily get it to work. So - - -

MR HANN: Thanks.

MR COLE: The next one was:

> *Can the CHPP be bunded to reduce noise impacts on local landholders? For instance, extension of the western placement to surround the CHPP.*

There is insufficient space between the extent of the mining tenure and the pit to construct a bund of sufficient size to be affected. Noise impacts under adverse weather conditions of the closest residence to the southwest, for instance apart from 127C, are negligible under the VLAMP definition or compliant with the NSW Noise Policy for Industrial Noise Limits. An acoustic treatment plan has been developed – a plan has been developed for 127C which has been shared with the owners. Whitehaven will continue to consult with the owners of property 127.

PROF FELL: Just a question. I've noticed in other mines they use acoustic cladding to reduce noise from CHPP.

MR COLE: Yes.

PROF FELL: Is that in your - - -

MR COLE: What we – what we found when we were modelling that because the noise levels above the 127 were generally permissible, you know, they were negligible above the 35 decibels, you know, full acoustic treatment wasn't necessary. We've provided for some degree of treatment of some of the – I guess, the more noisier elements of the plant. You will see when you have a look at the noise assessment and the sound power levels but generally what we found was that it wasn't – it wasn't required.

PROF FELL: Does that apply even in adverse .....

MR COLE: Sure. Sure. Well, all that – the modelling is based on the most adverse conditions.

PROF FELL: Okay.

MR COLE: The EIS indicates that rehabilitation will be progressive with soils from newly cleared areas being used on rehabilitated areas. Significant parts of the north and the west of the proposed mine are previously rehabilitated sites and those soil data for the reconstructed soil properties in these previously rehabilitated areas has been provided in the report. Is data available which demonstrates that the soils from these previously rehabilitated areas will be suitable as source materials for progressive soil profile reconstruction. Soil testing – our response is the soil testing conducted at the approved mine and the project included test bits within the previously mined areas.

The soils test confirmed that there is sufficient soil on appropriate properties to support the project rehabilitation objectives. Can the outer batters of the emplacement be made to blend in with local topography with more natural drainage lines and hill valleys, for example, the GF ..... type design. You will notice in the rehabilitation section of the EIS the rehabilitation strategy proposed for the project includes the application of micro and macro profiling to the deliver a natural

topography of the overburden dump. This is an improved outcome compared with the approved mine.

PROF WILLGOOSE: Before you go on, just in terms of the soils – the reason for that question is that we knew that there were pits that had been dug on the previously rehabbed areas but in the report the results from those pits have not been provided. And so there are some – I can't remember but when you look at the pits that have been provided in the report, they're all for the natural topography and there are, if I recall correctly, two or three pits that have been done on the rehabbed area but the results are not in the report.

MR COLE: We will respond to that in the written responses.

PROF WILLGOOSE: Yes.

MR COLE: We do intend to supplement what we say today with detailed written responses. We will include that in there, Garry.

PROF WILLGOOSE: No, I just thought I would clarify what drove that specific question.

MR HUNT: That's good.

MR COLE: Fair enough.

MR HUNT: That's good then. We will make sure we do that.

MR HANN: Okay. Thanks, Josh.

MR COLE: What plans do Whitehaven have for Kurrumbede that would be of value to the local community. The rail spur line and other infrastructure has been developed to have minimal impact on Kurrumbede. None of the buildings in the Kurrumbede complex are on or near the rail spur alignment. We've – Whitehaven has committed to developing a conservation management plan for Kurrumbede. It is also committed to a significant financial contribution for enhancement of the grounds of Kurrumbede with a view to being able to provide for some access to the grounds in the future. The proposal has been shared with the Mackellar Memorial Society for comment and input to the process.

MR HANN: Brian, how recent is that conversation?

MR COLE: It goes back to last year some time.

MR HANN: Okay.

MR COLE: And, as it turns out, our chairman and CEO are due to meet with that society quite soon.

MR HANN: Yes.

MR VAN MAANEN: Yes, it's probably worth mentioning – I mean, obviously, in addition to the CEO having publicly committed to the preservation of Kurrumbede Homestead at the Boggabri IPC hearing, the chairman of the company, Mark Vaile, is also a patron of the Dorothea Mackellar Memorial Society so we will be continuing to work cooperatively with them on the application of this – of this funding commitment and, as Brian indicated, we will meet with them in the not too distant future.

MR COLE: The next comment that was raised was if Vickery Mining is now an independent entity of Whitehaven can they provide guarantees re commissioning the Southern Blue Vale Road coal transport and Gunnedah CHPP. There seems to be some misunderstanding here. Vickery Mining is a wholly-owned subsidiary of Whitehaven. Such a structure is consistent with the corporate structure of other Whitehaven mines.

Economic necessity will mean that as soon as the rail spur and CHP are fully commissioned Whitehaven will use the infrastructure that it has invested in as rail transport and processing through a new modern onsite CHP as considerably more cost-effective than road transport and processing through an older, more costly to operate plant. So the economics will drive that in the future. So I will now pass over to our specialists and first cab off the rank is Dr Noel Merrick.

MR VAN MAANEN: If you want to drive this yourself. You just click the left-hand button to progress. That's not working.

DR MERRICK: Really.

MR VAN MAANEN: Yes.

DR MERRICK: Okay. Okay. Well, I will provide a summary in the first few slides of the groundwater assessment and then move onto the seven specific questions that the panel has requested responses to. First of all, the groundwater assessment studies were done by staff of HydroSimulations under my supervision. The assessment has been reviewed on two occasions or by two separate people – internally by Dr Frans Kalf and externally – a DPE peer reviewer, Hugh Middlemis.

The model – there was – the original model back in 2012 for the original EIS, that model was updated in the year 2016 for primarily to convert the software from a different version of MODFLOW to MODFLOW-USG which had been introduced globally not too – probably a couple of years before 2016. And since that time there has been no major revision to the model other than the operational scenarios of mining plans and various operational options. And, of course, in going from 2012 to 2016 there was the incorporation of additional data. There was much more drilling, continuous monitoring and so on. The model domain is – has to be much larger than

the actual mining area and it's of the order of, you know, 30 kilometres by 30 kilometres – roughly in that dimension.

So it deliberately goes as far north as Tarrawonga so that the cumulative effects of that can be captured and it includes Canyon and Rocglen mining operations as well. There's nothing – no other mining to the south so there's just a reasonable cut-off through the alluvium to the south and it extends to the west to hard rock outcrops. It is a big model. It has over one million cells. A rule of thumb in modelling is to try to stay under one million cells so that rule limits the degree of resolution that we can target in a model, in particular the number of layers that we can represent in a model so there has to be some aggregation of individual seams and the ..... between seams – 14 layers in all.

Calibration – a necessary step in any modelling exercise – has been primarily to groundwater levels but also has been cognisant of information – the inflows of Canyon and Rocglen and at Tarrawonga, actually. The peer reviewers have generally given the assessment a tick. Frans Kalf described the calibration as very good and Hugh Middlemis described it as a sound predictive tool. The assessment objectives, in general, any impacts to quantity – quality of the regions groundwater resources but also any impacts on the Namoi River in the sense of does the project cause more water to leak out of the river or more water to leak out of the alluvium to the hard rock and whether there are material impacts on a lot of third party bores, other groundwater users. The key conclusion is that the two metre groundwater draw down, the primary criterion in the aquifer interference policy, is essentially isolated to the hard rock island that – where the mining is to take place and does not extent significantly into the Namoi River alluvium in any direction.

Another key conclusion is that the final void would act as a permanent gravelled sink. In terms of the aquifer interference policy, the compliance is at the level – at level 1, which means that it meets the two metre draw down criterion. In fact, it is much less than two metres at the nearest privately owned bore or the Boggabri town water supply bore. In terms of the aquifer interference policy, the – there are two groundwater quality criteria. One is no change of beneficial use of the groundwater and the other is no increase in – well, less than one per cent increase in Namoi River salinity. And that – both of those conditions are met.

The predicted inflows into the mine, both during and post mining, are within the quantum of the licences that are currently held. There is – has been modelling of a contingency bore field and that is shown to cause less than .2 metres draw down at the closest private bore, but more of that later. Just to indicate this on the right, these dots are the – an indication of the, well, preliminary design of the positioning of the bore field, consisting of 10 bores, each 500 metres apart. And then, the Boggabri town water supply is six kilometres to the west and the nearest private bore at five kilometres where the predicted draw down is 20 centimetres inclusive of operation of the mine and the bore field.

Just a couple of comments taken from the two peer reviews, without reading them all out. Just concentrate on what's highlighted. Conceptualisation is suitable. The model layering is suitable. Middlemis: fit for the purpose of mine dewatering environmental impact assessment. The monitoring program and investigations are well designed. And there is a mention here that the work is a suitable prelude to comprehensive uncertainty analysis. Now I just want to note that the – there has been a guideline issued by the IESC for uncertainty analysis; I think Christmas Eve 2018.

PROF WILLGOOSE: Yes.

DR MERRICK: There was a draft back in February 2018 and these post-date all the modelling that was done. So the VIC EIS does not have the level of uncertainty analysis that the IESC is now expecting. There will be a formal response to submissions by responding to each of the peer review comments and to the seven IPC questions and I'll now move on to a summary of the responses to those – to your questions. First of all, what's the stratigraphy and what is it based on. Well, in the report, the stratigraphy as modelled is shown here. These are the 14 layers. And you will notice that the even numbered layers are the ones that hold the coal seams but because of our computational restrictions, most of those layers have composite coal seams so we have a mixture of coal and interburden in layers.

It's only the Nagero Upper Seam that is isolated as a single layer but all the others are aggregated. Okay. There's a lot of fundamental data on which to base the stratigraphy. It is pretty well known – quite well known so – you know, there's published regional data, geological maps, hydrogeological studies, not only at Vickery but at, you know, Canyon, Rocglen, Tarrawonga, Boggabri, Maules Creek. There's a lot of work in the area but one thing that's generally not known, it doesn't seem to appear in anybody's reports – and that is that the alluvium thickness in the Namoi valley and up the arms to the north and south of Vickery, were determined by a drilling program and seismic refraction surveys in the late 1960s.

And I'm aware of that because I worked in the geophysics section of the state government. I joined in 1972, at which point the drilling and seismic refraction had merged into the Lower Namoi. So that's why I'm aware of all this excellent work that was done in the Upper Namoi that no one else seems to know about. Regional bore logs, groundwater monitoring data from which you can infer properties, and for this EIS, you know, quite a bit of alluvial definition drilling. Fairly shallow holes to try to – well, transects – a couple of transects of shallow bores to get to the base of alluvium and to go across where the alluvial boundary was suspected.

And there has been some excellent transient electromagnetic surveys done in two locations and that's very good at delineation. There is ambiguity between where the alluvium stops and the weathered zone starts. It's not always detectable, either in the drill core – drill chips or – and the geophysics. But our finding from that was that the geological mapping of the alluvial boundary was pretty close to right, with minor shifts here and there but pretty good on the whole. Now, at the – finally, there is a

very detailed geological model at the mining site, based on exploration drilling, as there is at every mining site, and before building our groundwater numerical model, we get hold of the geological model .....

And so we construct our model from those but do some aggregation of course. The geological model will have hundreds of layers and we have to aggregate from that. So we have very – we're very confident in the geometry, especially over the mining lease, but we also have the geological model at Tarrawonga. And then we have to infill between those with the other more regional information.

PROF WILLGOOSE: Before you go on to the next slide, just one question I guess about the mapping that was done – the 60s mapping done on the northern side of it. Did they just map the alluvium thickness or did it also look at hydro-properties like conductivities and storativities for that area?

DR MERRICK: No. As far as I know there was no other – there might have been some plumbing tests done but not much else in the way of investigation. So there's really nailing the geometry - - -

PROF WILLGOOSE: Okay.

DR MERRICK: - - - and then the seismic refraction was – what its good at - - -

PROF WILLGOOSE: Yes.

DR MERRICK: - - - is picking the water table and picking bed rock - - -

PROF WILLGOOSE: Yes.

DR MERRICK: - - - and not much else.

PROF WILLGOOSE: Yes. Okay. So in other words, to the northern side of the mine, where the bore field is - - -

DR MERRICK: Yes.

PROF WILLGOOSE: - - - there is not much information about the hydrogeological properties.

DR MERRICK: Not at that time. No. But I'll move on to - - -

PROF WILLGOOSE: Okay. Yes, okay.

DR MERRICK: I will - - -

PROF WILLGOOSE: Okay. If you're - - -

DR MERRICK: It's probably this slide actually - - -

PROF WILLGOOSE: If you're going to – okay. Okay.

DR MERRICK: - - - that I am going to make some comments on the knowledge in that area. Sure.

PROF WILLGOOSE: Okay. Good.

PROF FELL: Just a general question. Faults seem to occupy the mind of a lot of modellers of other mines. Can you give me an overview of the ..... situation?

DR MERRICK: Faulting?

PROF FELL: Faulting. Yes.

DR MERRICK: Okay. All right. Yes. There are four or five distinct faults going through the mining lease. They are all represented in the model in terms of their geometry.

PROF FELL: Right.

DR MERRICK: So any offsets that occur in the faults appear in the site geological model.

PROF FELL: Right.

DR MERRICK: So we transfer that geometry to the numerical model. We don't, as a rule, give those faults any hydraulic properties. My view is that the principle ..... applies, which means keep things as simple as possible unless there's a good reason otherwise. So I won't give a fault any specific hydraulic properties unless there is evidence that they affect the groundwater contours or groundwater flows.

PROF FELL: .....

DR MERRICK: Okay. So that means that, implicitly, I have an assumption that, across a fault, the coal seam rolls over. That is not cut off, so there is assumed continuity of coal seams in the model. That has a consequence of being conservative in the terms of lateral impacts. So in the model – the model would transfer impacts more broadly than it should, laterally, but the drawdowns immediately above in the mining lease, the opposite would hold.

PROF FELL: Thanks for that.

DR MERRICK: Hydrogeological parameters ..... so this gets to your question, Garry, essentially. Storativity, specific yield, hydraulic conductivity and anisotropy. The table here gives a summary taken from the report for each of the 14 layers of the

adopted, calibrated horizontal ..... hydraulic conductivity, vertical hydraulic conductivity, storage coefficient and the specific yield. I won't go through the numbers. So they are fundamentally constrained by any published or monitored or field investigations and there was site-specific work on ..... tests and about 30 core tests, I think we did, on both horizontal and vertical. Those initial constrained ranges of parameters are refined during the calibration process to get a set of properties that is compatible with the observed groundwater levels and inflows.

Now, I've got to say that the – all right. The IESC noted that the specific storage values in alluvium model layer two could be unrealistically high. They don't say why. I can only assume, because of recent IESC advices, they have a reference to a paper published about six months ago by ..... which advocates a finite range from 2.3 to -7 to 1.3 to -5 per metre. I have not seen any other paper in the literature that advocates a finite range, but for the time being, it's a good working range. So my next point is that I've got to say that the IESC got it wrong because the report does not show specific storage. It shows storage coefficient and they are not the same thing. So a storage coefficient is specific storage not applied by layer thickness and therefore has to be a higher number than specific storage.

So what I've done is take our storage coefficient values and divide by a medium thickness to come up with equivalent specific storages and they are – they vary for the subject layer three to -5 to ..... to -4. So they are a little higher than the range advocated by rail, but the difference – difference – you need about an order of magnitude changed ..... storage have any noticeable impact. So I don't see any difference between the values we've adopted, compared with the advocated upper value as being significantly more and, on the other hand, there is a government model and has been for – since 2006 for the upper ..... which is extremely well-calibrated, and they use specific storage values of ..... -4 to ..... -3. So ..... order of magnitude lower than the values they have found by calibration.

Okay. So my view is a – any further reduction in modelled storage values would not increase the risk of drawdown of greater than 2 metres at water supply works, which is the main criterion anyway. The – oh, yes. I've got here. In our formal response, I will include maps of the procedures taken by the New South Wales government and they initially estimated both specific storage and hydraulic conductivities from textual analysis of bore logs, which gives quite a spatial distribution of values and another point that might come up in a later slide is that those hydraulic conductivities that they assessed by that method and then they subsequently simplified them a bit through the calibration process, the values in our model are compatible with the values in their model for hydraulic conductivity, but the specific storage values are an order of magnitude lower.

What's reliability of bore field predictions, given the no test wells? What sensitivity studies? Okay. All right. First of all, the bore field is only contingency. It's not a definite. It's only going to be required, you know, when there is a shortfall of captured water or licenced extraction from the ..... river and the surface water modelling studies suggest that that's a period of maybe four to six years that it might

be needed. The bore field design operation is to be consistent with water sharing plan licencing requirements, which is all to do with geometry, really. So there are rules for the spacing of bores, rules for distance of a bore field from neighbouring bores, from property boundaries, from departmental monitoring bores and so on, that they're all geometry rules.

There are no other impact rules associated with it, at least not in the current water-sharing plan. I expect, when the water-sharing plan is revised by next year or so, there will be some impact criteria, but right at the moment, there aren't. The bore field modelling was ultra-conservative in that it was assumed that these bores would put out 600 megalitres a year continuously, whereas the reality is that the current licences held are now less than 400 – slightly less than 400 megalitres a year and, as I said, the bore field, at most, would ..... Now, on this map, there's a legend here showing the allocations of megalitres per year of all the production bores going up the valley here and we've put a little dot over the mine plan to indicate if the – if that were an equivalent bore, how it relates to all of these. So compared with the other productivity in the valley, it's a small-time player.

Okay. In the inset here is the two metre drawdown contour expected from the bore field and cumulatively with the mining. So it's very tight. It's not going to move out very far. The alluvium property at the bore field are well-defined through calibration. They are consistent with the New South Wales government model and a map of the alluvium thickness and the hydraulic permeability will be in the formal response. Now, my view is that the risk of an impact on the nearest production bores is too low to warrant sensitivity analysis.

In other words, the drawdown is so tight here that there is no way I could get a model to have an impact out here at the nearest production bore without decalibrating the model. And I believe we have a very reliable representation of the permeabilities in that area and we certainly know the geometry very well because of the ..... studies. Right. Post – rehabilitation – groundwater transients are observed for 300 years – I don't know where that statement comes from. It's not in the groundwater report. It's not in the surface water report. Show results of drawdowns for 300 years as the groundwater report only shows 100 years. Okay. Justify it will be a sink – all right.

For all prediction scenarios, the final void has been a sink and a significant sink – it's not even close to being doubtful. Now, groundwater modellers defer to surface water modellers for doing final void analysis most rigorously. So in groundwater models, we have vertical sides on final voids. We don't have a proper final landform as a rule in an EIS. We don't have a rainfall runoff model in it. We don't have stochastic climate. These are all – and we don't have salinity calculations, unless we go to a ..... transfer model. So these are all things that are better handled in a surface water model which is essentially spreadsheet format, so it will run very fast. In contrast, the groundwater model for the final void run for 100 years took 14 hours.

So we just cannot compete with surface water model which ran for 1000 years. We could never do that with a groundwater model in a reasonable time. Okay. The

surface water assessment considered four climate change scenarios. The job of the groundwater model is to provide a discharge-stage curve to the surface water modellers. That goes as an input – in a groundwater input amongst all the other inputs in a final void assessment. The finding and the graph here shows the void – predicted void water level out to 1000 years from the surface water modelling and I've just marked where the 100 years – where the groundwater model stopped and 300 years which is where equilibrium starts – things start to settle down.

So running the groundwater model for 300 years, which would take a long time actually – it's not going to add anything to the story. It would add 10 to 20 metres. If you compare the difference between 100 and 300, you might get an extra 10 or 20 metres on the water level height in the groundwater model, but the hydraulic gradients around the rim of the final void are so steep that another 20 metres won't make any difference. It will always be a very strong gradient towards that void. Okay. The sensitivity of pit lake elevation to groundwater parameters. Right. And then the question about solutes moving away from the void.

Because it is a strong sink, groundwater flow would always be to the void and not from the void so there is negligible risk for any water quality impacts emanating from the final void. The pit lake elevation I believe is not sensitive to groundwater parameter assumptions for a few reasons: one, the inflows – the groundwater inflows are really minor compared to rainfall, rainfall runoff and evaporation. In fact, the inflows are of a size that they will essentially get evaporated off the walls before they even participate in raising the void water level. Changes in regional – the host groundwater properties would have a negligible effect on the discharge-stage curve that we produce, the reason being that the material surrounding the final void is spoil.

So the discharge-stage curve is controlled by the spoil properties. Now, admittedly, they are assumed values. But we base our estimates on the work done in Mackie's PhD. So we've adopted a one litre per day laterally, 0.1 litre per day vertically. Spoil properties in theory should have a slight effect on the discharge-stage curve, as the hydraulic gradient through the spoil will change proportionally with the adopted property, but since these slides were prepared, I did some trial runs over the weekend with three different levels of spoil properties, and while the hydraulic gradient changed, as expected, the inflows did not.

They shifted by less than 1 per cent. So for current final landform design, I believe there's negligible risk of the final void not acting as a permanent sink. Sensitivity to potential climate change – okay. Both assessments – groundwater and surface water – have considered climate change – changes in rainfall and evaporation. Post-mining has been done in the surface water assessment by Advisian for four climate change scenarios which were combinations of maximum rainfall reduction or increase, depending on which model we picked, and maximum reduction or increase in evaporation, depending on which model you picked. So that was the four. And they correspond to the four curves that were shown on the final void diagram.

During mining, a groundwater assessment and the surface water assessment considered the effects of short-term climate change with these different models. I marked them CCIA and CSIRO. The groundwater model ran one of the CCIA scenarios with reduction in rainfall of about 3 per cent on the short-term and that led to a 1 per cent change in mine inflow. So it was found to be insensitive to recharge variation. And we – the surface water modelling did similar things during mining. So the site water balance predicts that the water supply demands can be met within current licensed allocations under the test of near – near-term, short-term climate scenarios. Right. And they – assessments – both assessments have been peer-reviewed. I've already mentioned that for groundwater. That's the end of my presentation.

PROF WILLGOOSE: Couple of clarifications. Okay. One minor one is when you mentioned NARCliM, you probably need to be a bit more specific. There are 12 sets of simulations in NARCliM that give very different climate projections. We've published some – some of our work – not to do with groundwater, I might say, to do with urban water supply and the results are very different, at least on the coast. I don't know what it's like at the site, but it's just a piece of advice, you know, to be very clear about which NARCliM simulations you're using.

DR MERRICK: Sure. Because I think we only mentioned one and it suggested an increase in rainfall instead of a decrease.

PROF WILLGOOSE: Yes. Some of them – in the experience we've had on the coast, some of them show increases, some of them show decreases. So it's worth actually looking at all 12 of them to get a sense of the range of projections and that's the advice from Jason Evans as well about having used NARCliM is to look at the range. Let's go back to the 100-year simulations versus 300-year simulations. I can't tell you right off the top of my head where it is – whether it's in the rehab section or not. The reason I asked specifically about that is to do with the long-term impacts on the regional groundwater. If you - - -

DR MERRICK: Yes.

PROF WILLGOOSE: There's a – you've got some – let me just try and find the – which set of contours they are and I will explain to you what my concerns are. It was – it's probably towards the end here – end of 2017. So it's the post – yes, so this is – yes, specifically figure 50. I'm sorry to be specific about this, but - - -

DR MERRICK: Yes, this is the 100-year prediction of groundwater levels? Yes.

PROF WILLGOOSE: Yes, that one on the left there. And the concern I have – and it goes back to the – you did a couple of gross-sections of the geology and I – it's just questions that need to be clarified – is that the geology of its being mined, the fault that's on the right-hand side that more or less defines the eastern boundary of your groundwater model, that fault doesn't go down and cut through all the geology; it only impacts on the surface and the geology that is being mined actually goes

underneath the fault – at least on your – on the conceptual geology. So there is a concern that – just a concern that needs to be clarified, I think in my mind - - -

DR MERRICK: I know that the fault – the ..... thrust fault is angled.

PROF WILLGOOSE: Yes, so - - -

DR MERRICK: And there is sediments wedging underneath which - - -

PROF WILLGOOSE: Just in terms of this map there, that's more or less about where your model finishes there, but the geology of its being mined goes underneath there. Now, what I don't know – and it we be useful to clarify – is potentially at 300 years, that means that potentially there is groundwater being drawn from the adjacent water-sharing plant. And so – so - - -

DR MERRICK: Which is the other side of the fault.

PROF WILLGOOSE: Which is the other side of the fault, so at 100 years, the contours that you've got there show drawdown from the impact of a pit and that sort of thing that go right to the eastern edge of your boundary which suggests to me that – it's a little unclear in those pictures which of those layers you're talking about in terms of the drawdowns as well. So, you know – yes, I'm looking at this and trying to figure out do these drawdowns – are these in the layers that go underneath that fault or are these the drawdowns in the layers that are cut by the fault? So there is a uncertainty in my mind when I look at this as potentially at that 300 year level when you showed the voids stabilising, where in fact some of that void stabilisation is occurring from water that is potentially being drawn from the fractured groundwater of the adjacent water-sharing plant. Do you follow the issue?

DR MERRICK: Sure. Yes, I understand.

PROF WILLGOOSE: I – you can't tell from the reports because they're not – the 300 – this is why I said the 300 year and it may be that the 300 year is in the rehab part of the report, I can't honestly remember off the top of my head. But it just would be useful to clarify because the report does assert that there are licenses supported for all of the extractions, yet if there is water being drawn from the adjacent water-sharing plant, that means that there need to be licenses from the adjacent water-sharing plant as well. They may not be significant, but they - - -

MR HUNT: Yes. Yes.

PROF WILLGOOSE: Certainly there may need to be.

DR MERRICK: Yes. So I will take that on notice and check.

PROF WILLGOOSE: Yes.

DR MERRICK: But my recollection was that in the model, rather than having that ..... as a vertical, we had it angled and we had sediments poking underneath. I might be confusing this model with another model where we have definitely done that.

PROF WILLGOOSE: Yes.

DR MERRICK: So I would have to check this particular model.

PROF WILLGOOSE: Yes. Yes. No, I - - -

DR MERRICK: But I take your point.

PROF WILLGOOSE: I'm happy for you to take it on notice. I just wanted to - - -

DR MERRICK: Yes.

PROF WILLGOOSE: - - - clarify – clarify that. And that was why the 300 years came up, was not so much to do with the operation of a mine but the post-mining behaviour.

DR MERRICK: Sure.

PROF WILLGOOSE: Okay. I think we're happy to take that on notice.

MR HANN: Yes, absolutely.

PROF WILLGOOSE: Yes. I guess you probably answered most of my questions about the – in terms of information about the – what's going on in the alluvials of the northern side. It probably, from our perspective, would be helpful if that was a more explicit a discussion of the information about the northern side. It appears from the report – it appears there's not much information from where the borefield is. And if there is information from this 1960s report and from the calibration about those models and this discussion of sensitivity, you've got to be useful – to actually have that explicitly in the report.

DR MERRICK: Yes. Well, the work done in the 60s is probably not reported. It will be in government minutes.

PROF WILLGOOSE: Yes. Okay.

DR MERRICK: It will be on survey diagrams.

PROF WILLGOOSE: Yes.

DR MERRICK: So it's - - -

PROF WILLGOOSE: I understand the problems of grey literature in that regards, yes.

DR MERRICK: Yes. Yes. It's – it is not mentioned in our report and I appreciate that it could – would help.

PROF WILLGOOSE: It's just that - - -

DR MERRICK: Yes.

PROF WILLGOOSE: - - - as the report stands, it looks like – it looks like there is no information for the alluvials nor for the site, and since all the boreholes and all the monitoring data tends to be on the western side of the river, and there's no active borefields on the eastern side of the river, there is a suspicion that there's something different about what's going on with the ..... border on the eastern side, otherwise there would be borefields there for farms on the eastern side.

DR MERRICK: Yes.

PROF WILLGOOSE: So - - -

DR MERRICK: Well, there's definitely lower quality material there and in our formal response we will include the maps from the New South Wales Government's report. There was work done in 2006 but finally published in 2012, but I will include the maps of - - -

PROF WILLGOOSE: Yes.

DR MERRICK: - - - alluvium thickness and the estimates that they've had of permeability.

PROF WILLGOOSE: Yes. Okay.

MR HUNT: There's also a test bore associated with Tarrawonga, a pump test in the alluvium.

DR MERRICK: Yes. And there are – well, just to the north of that borefield there's quite a few Tarrawonga landowner bores close to Tarrawonga that are part of their monitoring network.

MR HUNT: Company owned, yes.

PROF WILLGOOSE: Okay. Yes. Okay. So - - -

DR MERRICK: Yes. So there is a bit more there, yes.

PROF WILLGOOSE: As I said, I mean, it probably would be in your benefit to be clearer about what information you actually have north of the mine site.

DR MERRICK: Sure.

PROF WILLGOOSE: Okay. I think that's - - -

MR HANN: All right for groundwater?

PROF WILLGOOSE: Yes. Yes.

MR HANN: Thank you very much, Dr Merrick.

MR COLE: Okay. Well, next on the agenda is the surface water. And I will call on Chris Thomas to present that section of our presentation.

MR THOMAS: Okay. Thank you very much. My voice is a bit scratchy so I might borrow that water before long. I've got a little bit with me. So - - -

MR HANN: That's – yes, let me fix that for you, Chris.

MR THOMAS: So to start off I will just give a little bit of background about myself. I've got 30 years experience as a water resources engineer having practised in all facets of water resources whether it be from ..... flood hydrology, flood hydraulics, surface water management, surface groundwater interaction, water balance, dam design – mostly small dams, I suppose, in the context of what we've seen over the years in the east of Australia – and in water quality analysis. I'm immediate past chair and longstanding member of the Sydney Division of the Water Panel of Engineers Australia. We regularly provide seminars on a whole range of water resources' related issues and sometimes they overlap with groundwater in that capacity.

In those years of experience I've been a principal hydrologist responsible for a range of surface water assessments for a number of coal mining projects in New South Wales, most notably for Ashton, Moolarben stage 1 and the EIS for stage 2, and also in – for the Mt Arthur Coal Project. More recently I peer received the surface water assessments for a range of projects including the Bylong Coal Project. Our particular surface water assessment report that we prepared which no one has referenced, it was peer reviewed by Tom McMahon, a very well highly regarded water resources engineer with a range of experience extending over 50 years. Before I get into too much detail, I should just reemphasise, and I think I heard Brian make mention of this, that ostensibly what we're looking at is an extension to an approved mine, and in particular, that extension has involved some movement to the south of the Vickery area.

And we've established through our assessment is that there's minimal impact on the surface water management regime as a result of that extension. One particular point

of note is that – and again, I think Brian made this point, the western placement is no closer to the Namoi River as a result of the extension. In terms of our surface water assessment for the extension project, we've set out to address a number of primary objectives. These were, firstly, to develop a water management system and water balance for the project life which did one of two – or two things: firstly, demonstrated there was sufficient water to meet the mining needs, and secondly, to demonstrate that water inflows could be effectively managed across the mine site. We also set out to assess the impacts of any changes to water flow and quality into the receiving environment.

The key conclusions that we established from that work were that the water management system, the proposed system that we put forward, would be able to be designed in accordance with the relevant guidelines which will prevent the distribution of any coal contact or mine water offsite. The water balance that was developed for the surface water assessment demonstrates that there's enough – there's sufficient licenses for the life of the mine and Whitehaven holds those licenses.

And we also established that the potential for downstream impacts on water flow and water quality are considered to be negligible. Before I drill into any of the detail associated with that analysis, it's probably worth emphasising or providing a bit of context around the nature of the streams that exist in the vicinity of the mine site. So, firstly, regional level. We obviously have the Namoi River.

It's the primary artery that drains the valley. It's a regulated river. It has got upstream dams, namely, Keepit, Chaffey and Split Rock Dam. At the local level we have a range of intermittent or commonly referred to as the ..... streams but I probably prefer to call them intermittent because, as I'm sure you've seen, if you've been out there it's very difficult to identify where these streams start and finish and where they resurface, and most importantly, they very rarely carry any runoff, and it's really only after episodic storm events that you will see that they do carry runoff.

Now, I think it's a very important point in the context of both surface water analysis assessment and also water quality assessment, which I will come to later in the presentation. At the detail level, if I just talk, firstly, about the water balance model. The analysis was undertaken to assess the performance of the proposed water management system in terms of the capacity to ensure the security of the water supply for operational purposes in order to assess the frequency and volume of any potential discharge of water from the site through the life of the mine, and to provide a tool which could be adapted and used for water balance monitoring and management during the operational phases of the project.

In addition, we completed a separate water balance analysis which was undertaken to assess the long-term water level and salinity in the final void following mine closure, and Noel has already made reference to that in his presentation. In terms of the results from the water balance modelling, I summarise those. In a similar fashion to the approved mine, the water management – approved mine water management

system, the proposed system for the extension project operates effectively and meets the water requirements for coal processing and dust suppression. The system is capable of operating with no discharge of water that has been in contact with coal.

So, the net effect, we've managed to achieve one of the primary objectives and that was to have a nil discharge mine and the water balance proves and shows that. In terms of surface runoff from other areas of the site, there's sediments dams proposed and, as is common with many mine projects, those sediment dam releases will be – there will be a requirement occasionally for sediment dam releases to restore dam capacity. And the objective there is to do that within five days of a rainfall event exceeding the design capacity, and that would occur via a controlled discharge in accordance with standard practice – that standard practice is outlined in a document called the Blue Book which is published by Landcom in 2004 – and also recognising the environmental protection licence conditions that would be applied should the proposal be approved.

The water balance modelling shows there's no significant changes to the quantity or quality of the surface water available to third party users or the environment. There's no risk of overflow from the final void following mine closure and I think that's evidenced by, again, what Noel put forward in some of the graphs that he showed, so I haven't repeated those here. Notwithstanding, it's noted that the salinity in the final void will increase to some extent progressively through the accumulation of salt. If we refer then to the assessment finding – so we've talked about the water balance, the water balance results, how that will function for the mine.

We also need to consider the potential for any impacts on the surface water regime. So, initially, if you look at the assessment with regard to the Namoi River, again context is fairly important. There's some reduction in the catchment of about two and a half square kilometres during the mining process and post-mining it would reduce slightly to a slightly lesser amount to 2.4 square kilometres. The next effect is that's about .01 per cent of total catchment draining into the Namoi River, so a very minor impact, if any. There will be approximately nine square kilometres of rehabilitated waste drop in placement area which would drain towards the Namoi River.

Irrespective of those two findings, we still find that there's no perceptible or measurable change in the flow regime expected within the Namoi River as a consequence of the project. In a similar fashion to the approved mine, there will be no change to the overall water quality of the Namoi River, and that can be concluded primarily because of the measures that are proposed to be undertaken to protect the quality of the water in the water courses that surround the mine site. So with regard to the ephemeral streams that are located around the site, our assessment established that at the outset with all water in contact with coal, that is, coal contact water being retained on site, there will be no impact from that water on any of the ephemeral streams located around the perimeter of the site.

Sediment that would be picked up in runoff from other areas of the site that are not in contact with coal will be controlled by a range of systems that are built into the mine water management plan. They include sediment dams, which I referred to before. Again, I emphasise that they don't hold mine water. Prior to any controlled discharge of water from the dam, water would be allowed to settle and that would be aided by a flocculent if required to ensure the suspended sediment concentration is less than 50 milligrams per litre.

In the circumstances where there's wet weather discharges and discharge to restore the sediment dam capacity, these would be undertaken in accordance with the environmental protection licence that would be issued should the proposal be approved. And they would specify particular water body requirements and limits, including the requirements for monitoring and discharge. And, finally, in terms of treatment of areas in the final waste rock emplacement, that will occur where there's some – where there's any areas that exhibit erosion and that will be treated with gypsum to, again, control what might end up back in the sediment dams.

PROF WILLGOOSE: When you're saying the placement face, you're talking about the outer batters?

MR THOMAS: That's right.

PROF WILLGOOSE: Okay.

MR THOMAS: That's right.

PROF WILLGOOSE: Okay.

MR THOMAS: Finally, implementation of those sediment control measures would, effectively, be the mechanism for ensuring that any controlled discharge would have minimal impact on the water quality of the local creeks. So that, in effect, is where we're trying to control any runoff to reduce any sediment that might be carried offsite into those streams and we've got a range of mechanisms in place to do that. Part of the proposal also recognises that there is a need for ongoing monitoring and licensing. To this end, the site specific water management plan will be developed.

It will be developed similar to the approved mine and that will include provision for climate monitoring, provision for site surface water monitoring and discharge, which is, I guess, what I've referred to in the previous few slides. It will include provision for ambient surface water quality assessment. It will include an allowance for ongoing water balance monitoring and management, which will be important to the mine operation anyway in terms of being able to have enough water at different parts of the site. And it will also be developed with due recognition of any environmental protection licence conditions for water quality monitoring in the sediment dam discharge.

So if I can move on the questions that were tabled, what I might do is I will read out the questions first. Some of them are a little long, so we will labour through them. So the first question that was tabled was:

In light of the Giles Review –

and when I say the Giles Review, just to recap, there was a review undertaken by BMT by Martin Giles – that's this document here – which is what we're referring to in these – pretty much all of these questions. So:

> *In light of the Giles Review, what does Whitehaven Coal consider to be a reasonable range of analytes to be monitored in surface water surrounding the mine and in water released from the mine to ensure no damage to the surrounding environment?*

So if I – obviously built it up in bold here as an important point, which I think I've probably said twice already, but we will say it again. But there's going to be negligible impact on the surrounding water quality because mine water is not proposed to be released from the dam – sorry, the project. Water that's captured in the mine water management system will be reused on site to reduce demands from external water sources. Irrespective of both of those objectives and constraints, there's a range of recommended analytes that would be monitored to – and those have been informed by the project air chemistry assessment, which was done for the EIS.

Those recommended analytes, if I break it up into areas of the site where runoff would be important to understand what the water quality of that runoff might be, we will break it, firstly, into the ROM coal stockpile. And, just to re-emphasise that point, there won't be any monitoring undertaken about water because we don't expect release any of that from the site. We won't be releasing ..... I imagine it's a condition of the approval anyway. Run off from the reject material – well, the dewatered reject material will be co-disposed into locations such as that run off and infiltration reports to – where run off and infiltration reports to the mine water management system. So, again, that'll be captured whether it be in sediment dams or other onsite systems for treatment and re-use as appropriate.

The groundwater quality to be monitored by testing from bores installed in the waste rock emplacement. That groundwater will be tested for a range of analytes including pH, DO, salinity, TDS, iron, a range of metals including iron, aluminium, arsenic, magnesium, molybdenum, selenium, calcium, sodium, chloride and sulphate, and, again, those have been informed by the project geochemistry assessment. Run off from the overburden and the interburden areas, again, informed by the project geochemistry assessment will – the monitoring will involve pH, electrical conductivity, total alkalinity or acidity, sulphate, aluminium, arsenic, molybdenum, selenium and total suspended solids in the sediment dams catching run off from the waste .....

PROF FELL: Can I ask a couple of questions here. One is the project's not too far away for me to worry about chlorine, fluoride. Any ideas about that – those .....

MR THOMAS: No. I don't at this present. I will have to take that on notice. I haven't thought at all about those, and we haven't really considered those at this particular point, from my recollection. I take it on notice.

PROF FELL: I mean, we have the ANZECC guidelines 2000. There was then a 2018 update but hasn't really changed things.

MR THOMAS: That's right.

PROF FELL: I just wonder do you do a complete analysis of all of those at some stage?

MR THOMAS: Meaning every analyte that's referenced in - - -

PROF FELL: Yes. Has somebody done that?

MR THOMAS: For this site for – well, maybe my next question will partly answer that. In terms of for the existing intermittent water courses and/or the Namoi River, firstly, no one has done it for the intermittent water courses, and part – the part reason for that is because over the last – well, since about 2014, we've been in drought conditions. So there's no water there to test.

PROF FELL: Correct. Yes.

MR THOMAS: And that has been a big issue. The whole range of analytes that ANZECC 2018 will reference, that has not been done, to the best of my knowledge, for the Namoi River, and I doubt whether it would be for any particular area along the Namoi.

PROF FELL: You've undoubtedly taken mine water, or what you anticipate to be mine water, analysed that, have you, or - - -

MR THOMAS: We've – no, we haven't. We've – what we've done is we've taken available data that's been available to us in the research in the literature, and we've taken the data from either nearby mine sites which will generate the same sort of outputs as this mine site would do, and we've also looked at, you know, data that's been gathered from sampling and testing that sits in a range of databases, and I refer to those, and you will see them here.

PROF FELL: Well - - -

MR THOMAS: The New South Wales Department of Industry database, monitoring of nearby streams which Whitehaven has done. That's documented in

our report, but I'm going to say that it's not the full range of analytes that ANZECC 2018 would list. Having said that, you know, there's not - - -

PROF FELL: Well, we've really gone on to this next question.

MR THOMAS: Yes, yes.

PROF FELL: So I will let you answer that.

MR THOMAS: Yes. So having said that, I don't think it's necessary to cart blanche monitor every analyte or parameter. That's a very costly exercise for no – again, you're better off focusing your energies and your funding towards those parameters you'd expect to see. For example, if a mine site surrounded by a – you know, I remember in Moolarben, the water quality monitoring – no one looked at sampling for iron, and I said, well, look, there's a hell of a lot of sands down there. It's that particular colour because it's going to have iron it. Why haven't we sampled for iron? So it's about thinking what the monitoring program should be, making the monitoring program fit for purpose in terms of what you expect to see in the – and that's why some of the data that we see here in the historical data gives us an indicator of what we should be monitoring for, and, similarly, the geochemistry reports identified that as well. If I revert directly to the question – I apologise. I'll probably repeat a few things here, but the second question - - -

PROF FELL: It's baseline. So - - -

MR THOMAS: Yes.

PROF FELL: You have some idea of what the future - - -

MR THOMAS: Yes.

PROF FELL: Check against.

MR THOMAS: But there is a couple of comments of relevance here which are just worthy of re-emphasising. So Giles indicated that the amount of information available on baseline water service monitoring Vickery EIS and the adoption of appropriate trigger values was a little less than desirable. Notwithstanding, the question really is if mines approve, what steps would Whitehaven taken to obtain adequate baseline service water quality data before commissioning of the plant, especially given its failure to do so today in the project that was approved in 2014.

PROF FELL: ..... quote from Giles.

MR THOMAS: That's right. And that's from Giles. So in response to that question, you know, we believe there's an extensive baseline dataset available for the Namoi River. However, the collection of recent monitoring data from local streams has been intermittent, as I said, by the intermittent flows. It has been inhibited by the

intermittent flows and the prevailing drought conditions. I think on my site inspection, there wasn't – I couldn't find, you know – you're probably more likely to find higher nutrient content, and the only area I could see in the intermittent stream that was – had held any water, and that would have been by the congregation of cattle nearby. So that, no doubt, has been an issue and presents as an issue if we want to get that baseline water quality monitoring. Secondly, just to re-emphasise the point, as there is nil discharge of mine water, there is limited potential for changes in downstream water quality as a consequence of that.

In terms of the available data, as I've indicated, there's a range of data which our report has referenced and tried to use that data includes data from a Department of Industry database, monitoring from nearby streams that was undertaken by Whitehaven, monitoring from mine water dams, sediment dams and final void water ..... for other mining operations in the region, not necessary those just by Whitehaven. There have been other – by other mines. And some data that was compiled previously for the regional Vickery coal mine EIS which is some years ago, but it does give some baseline background information.

So notwithstanding all of the above, we recognise that there will be a need to do ongoing baseline service water monitoring leading up to commission. Whitehaven's fully cognisant of that, and that will include through the course of the development of the project – that will include the – some monitoring of the ephemeral or intermittent streams. That would probably have to happen on the back of episodic events so that we can see – have water in the streams, and that becomes a function of being able to mobilize, get out on site, get the samples and then get them back to the lab and test them fairly quickly.

PROF FELL: I think the point being made here is beyond potential approval, you then need to start monitoring before construction gets heavily underway.

MR THOMAS: That's right. Yes, yes. And, you know, that – and then once construction is underway, there's also an obligation to - - -

PROF FELL: To monitor.

MR THOMAS: - - - keep monitoring the sediment dams and any potential future controlled discharge that might occur from those sediment dams should there be, you know, major flooding or the sorts of events we saw in January 2011 in Queensland where, you know, mine water dams were overtopping. Bearing in mind, of course, in those sorts of events, the dilution factor is so significant that the contribution will be very minor to any water quality deterrent downstream through the Namoi.

PROF WILLGOOSE: Although, one of the problems in Queensland has been that those pits have filled up, and now there is a question of how to get that water out post-storms to the extent that – I can't remember which of the mines it is has actually been decommissioned solely because they can't get rid of the water.

MR THOMAS: So, in conclusion, I guess we've got two points. There'll be work done for baseline monitoring in the period from approval to commissioning. There will be ongoing baseline monitoring after commissioning, and then on top of that, there will be, through the project's life, there will be monitoring of assets within the mine site to keep an eye on particular analytes within sediment dams and areas where control discharge has the potential to occur down the track. The next question – the third question is – and I quote, from Giles. Given the – no, I beg your pardon. It's not from Giles. It's from the Commission.

> *Given the proposed use of untreated mine water for process applications, is there a possibility of solute build-up in water on the site and a concomitant threat to the surface and groundwater?*

Second part of the question:

> *Is there a case for treating process water to remove solutes and to make excess water available for beneficial purposes?*

So with – break it up into two parts and just talk about the solute build-up in the water on the site. There is potential, but the potential is considered to be low. In terms of a risk to the surface – the surrounding surface of groundwater, I don't believe that there is the risk of that, because the solute itself will be either lost as coal moisture during the processing exercise or – and any residual process water will make its way to the final void, where it will be retained over the life of the project with negligible risk of recharging the groundwater system.

And that's evidenced again by the graph that Noel presented, which shows the differential in elevation between the maximum surface water of the void and its connectivity level to – to the aquifer – to the groundwater system. In terms of the second part, treatment of process water, remove solutes and make it – to make excess water available for beneficial purposes – so I saw this question as one of saying okay, well, we have a situation where we might be able to use that water for something else rather than just letting it make its way to the void.

PROF FELL: That is a concept - - -

MR THOMAS: Yes. Okay. So I guess from the mine's perspective, there's water going to be captured from a range of other sources, the mine water dams – sorry, the – water captured from the mine water dams, the coal dams and the sediment dams will be preferentially used to meet the onsite water demands. So in other words, we've said we're going to preferentially capture and treat and use that water onsite. So in terms of the water balance, that water is critical to that site water balance. So as a result, we haven't looked at any particular plans for offsite reuse because we want to have access to that water for the mine operation and to ensure that we then don't have a need for seeking for some reason down the track external water sources. We would like to reduce our need to draw from those. And therefore that's why we - - -

PROF FELL: Can I ask a couple of questions on that. I'll take the second one first. And basically – so you're saying effectively there will be no – there will be zero liquid discharge from the mine.

MR THOMAS: That's correct. Except in the circumstances where we get – where we get - - -

PROF FELL: Heavy rain. Prolonged heavy rain.

MR THOMAS: Heavy rain that is beyond the design criteria that we've identified for various onsite sediment dams and the like. Bearing in mind those sediment dams have actually been overdesigned. So they're designed for the worst possible condition through the course of the mine life, which is the maximum catchment that could discharge to them. So they will always be – except for a very small window in the design life – they will be overdesigned.

PROF FELL: And certainly some of the agency reviews suggest they're worried about the size of them, even though you say they're overdesigned, but that's a case, I think, for caring ..... next step, if you like, plant design.

MR THOMAS: Yes.

PROF FELL: But – so effectively – how much water are you estimating will be over and have to be discharged in a given year? I know it depends on the climate.

MR THOMAS: It will, yes. Exactly right. So - - -

PROF FELL: But water's so precious.

MR THOMAS: Sure.

PROF FELL: I mean - - -

MR COLE: Take it on notice, Chris.

MR THOMAS: I have to take it on notice.

PROF FELL: Okay.

MR THOMAS: That's a difficult – it'll be dependent on the scenario you want me to look at. Yes. So I have to take it on notice.

PROF FELL: Well, do it over 10-year average.

MR THOMAS: Okay. We can - - -

PROF FELL: Okay. But going back to the first one, essentially, you're using water that has got solutes in it for things like dust containment. That water is then being picked up again, I suspect reused, it is not - - -

MR THOMAS: Yes.

PROF FELL: - - - for the same purpose.

MR THOMAS: Well, it will be reused for coal washing activities so it's kept in the same circle - - -

PROF FELL: That's right. Circuit.

MR THOMAS: Circuit.

PROF FELL: So - - -

MR THOMAS: It's not – it's distinguished from ..... run off from other areas of repatriated areas of the site.

PROF FELL: So there will be, in time, a build-up of concentration within that, will there not?

MR THOMAS: There is potential for that, yes. And that's – but that – that water will make its way to the void so it's always going to be contained.

PROF FELL: When will it make its way to the void? After how many cycles?

MR THOMAS: Well, I'll have to take that on notice. I'm not sure how many cycles.

PROF FELL: Do you pick up the point I'm making that there'll be a net build-up of salt in the system?

MR THOMAS: Yes. But there might be a net build-up as a function of evaporation as well in the void and then there might also be a net reduction as a function of rainfall. It's variable.

PROF FELL: Well, I – I'm glad you mention evaporation because where you use it, say, on roadworks you're actually building up the local salt concentration on the roadway over time. Is there a risk that there will get down to groundwater?

MR THOMAS: Well, my understanding, and I defer to Noel on this point, is that it – the risk is minimal because of the limited capacity for recharge of the groundwater system at those elevations.

DR MERRICK: Look, it's a mechanism that is feasible, it should happen, but the magnitudes are going to be very small and very drawn out in time.

PROF FELL: Basically, what I'm seeking is, is the geology right to make it very small?

DR MERRICK: Well, yes it is, because it's essentially weathered material or spoil. Spoil is certainly going to drain to a void and I would have to have a closer look at where it has been placed on roadways or whatever, to see if it's outside a catchment that's draining to a void,

MR THOMAS: Yes.

PROF WILLGOOSE: Is – I mean, you just mentioned that spoil will drain to a void but the western emplacement is partially, at least, emplaced on the natural topography - - -

DR MERRICK: Yes.

PROF WILLGOOSE: - - - so there's potential for drainage from the western emplacement off-site in that regard because it doesn't – because that's not necessarily going to – some of the inner part will probably drain - - -

DR MERRICK: Yes.

PROF WILLGOOSE: - - - to the void but the outer part will - - -

DR MERRICK: That has been examined - - -

PROF WILLGOOSE: Yes.

DR MERRICK: - - - the potential for seepage from the western emplacement to the alluvium, and I looked at that very carefully. The western emplacement actually straddles the catchment - - -

PROF WILLGOOSE: Yes.

DR MERRICK: - - - and I – I forget the percentages but the majority heads back to the void. And there's a small amount heading west and I don't recall the numbers but I did do some estimates on mass.

MR HUNT: It's presented in the EIS that - - -

MR HANN: It's – it is documented. Yes.

PROF WILLGOOSE: I recall my discussion - - -

MR HUNT: Yes. And quantified. All the outcome of the model quantified.

MR HANN: Yes.

PROF WILLGOOSE: Yes.

MR HANN: Yes. Okay.

PROF WILLGOOSE: I do recall a discussion of that. Yes. I just wanted it clarified because you said that – all of the waste would actually drain to the void but there's a little bit that does not drain to the void - - -

DR MERRICK: Yes. I was thinking it was spoil filling – the backfill - - -

PROF WILLGOOSE: Yes.

DR MERRICK: - - - into voids - - -

MR THOMAS: But there'll be a face, yes.

DR MERRICK: ..... the emplacements.

PROF WILLGOOSE: Yes.

MR HANN: Yes. Okay.

PROF WILLGOOSE: And are we satisfied that there's no risk of the void contaminating groundwater sources?

MR HANN: Well, I think we've heard from - - -

PROF WILLGOOSE: I think – yes – that - - -

MR HANN: Noel - - -

PROF WILLGOOSE: Yes. I think Noel has provided his view on that. I know that, in general – and this is not just to do with Vickery I know but there is a lot of concern about voids impacting on groundwater in general, both from the technical community and the regulatory community, but I – you know, I mean, in terms of specifics to do with Vickery, I think Noel has presented what he's got.

DR MERRICK: The important consideration is whether the void remains a sink.

PROF WILLGOOSE: Yes.

PROF FELL: Indeed, I appreciate that.

PROF WILLGOOSE: Yes.

DR MERRICK: And that's it, because backfilling with spoil.

PROF FELL: May disturb that.

DR MERRICK: It's disturbed it with material that is much more permeable than what was originally there.

PROF WILLGOOSE: Yes.

DR MERRICK: So changes the hydraulic gradients from what was there before, their flatter gradients, but they're all heading to the sink. They've got nowhere else to go.

PROF WILLGOOSE: Yes. I mean, maybe in a slightly different context, but the CSIRO biophysical regional assessment for the Hunter Valley has talked about a potential mechanism where, specifically for some of the mines in the Hunter Valley, there is – because there's higher conductivity in the spoil, what you end up with is in the uphill side of the mine spoil, the groundwater is supressed, but on the downhill side, because of the fact that it's all a bit like a bathtub relative to the regional groundwater, there is the potential for water to be flowing out of a spoil. This is particularly the case of refilling of the voids.

PROF FELL: Well, you had mentioned that one.

PROF WILLGOOSE: Yes. That's actually documented in the CSIRO biophysical regional assessment for the Hunter Valley as a mechanism.

DR MERRICK: Some doors can be flowthrough systems but Vickery won't be.

PROF WILLGOOSE: That's – yes, no, and that's what I'm saying. For Vickery I think - - -

MR HUNT: Strong gradient.

PROF WILLGOOSE: Yes. Yes.

PROF FELL: Okay. I'm happy with the surface water .....

MR HANN: Okay. No.

PROF FELL: No further discussion.

MR HANN: Thanks.

PROF WILLGOOSE: The – probably - - -

MR HANN: No, Garry - - -

PROF WILLGOOSE: I mean, there's one that's no question on notice, but is that the – I think it was Tom McMahon's peer review that talked about the PMF that was used for the bunding around the ..... suggested that you shouldn't be using a three times 100 year event on – you probably – I would think it would be advisable you go back and use a GSTMF that - - -

MR THOMAS: Yes. Sure.

PROF WILLGOOSE: To get better justification for that.

MR THOMAS: Yes. Look, the three times, it has been around for a long time and I guess with ARR 2016 or shall we call it ARR 2019 because it's evolving all the time, there's, you know, merit to - - -

PROF WILLGOOSE: Well, the ..... method has been around longer than that, so, yes.

MR THOMAS: Yes, it has. Yes.

PROF WILLGOOSE: Yes.

MR THOMAS: Okay. We can do that. Do you want me to talk to this last question or - - -

MR COLE: Well, Chris said he's - - -

MR THOMAS: I think I've probably already covered it.

MR HUNT: You've covered it.

MR COLE: You've covered it, yes.

MR HANN: All right. No, thanks very much, Chris.

PROF FELL: Thank you.

MR COLE: We can move on to the flood assessment, Greg ..... step forward.

MR ROADS: Nearly need a coffee. Yes. So my name is Greg Roads. I'm a director of WRM Water & Environment, Brisbane based consultancy. I've got 30 years experience as a water resource engineer specialising in floodplain management. If I could find this mouse.

PROF WILLGOOSE: Took the – took the - - -

MR HANN: Looking for the .....

MR VAN MAANEN: I think Chris might have absconded with it.

MR HANN: It has been pocketed.

PROF WILLGOOSE: What, there's two – there's two mouses.

MR THOMAS: I've got one of my own, so it's obviously a bad habit.

MR HANN: There's mice.

MR ROADS: I wasn't doing this from memory. I actually had notes. Yes. Starting ..... and there's a cadet engineer of the New South Wales Department of Water Resources and the Department of Land of Water Conservation in the rural flood group and whatever of the names it has – or departments it's called now. I really don't know. I do a lot of floodplain management work. I'm currently doing floor risk management plans for the town of Narrabri which is on the Namoi, just downstream, so I know the Namoi very well. I did their flood study for them a few years ago. I've done the Moree floodplain management plan as well which included pretty extensive flood modelling of the Gwydir River. I do a lot of peer review work for New South Office of Water and their assessments of levies in terms of management of that.

This flood study that we've done, we originally developed in 2011 for the previous Vickery South project. They were looking at a rail spur option as well. And it's just evolved from there as models have got more powerful and things like that. A peer review for the model was undertaken by Rohan Hudson from Royal Haskoning, and he has got 18 years experience as a water resource engineer and he also does a lot of peer review work for the government as well. Okay.

So when we started on this project, I guess we developed these models so that we could assess the potential impact of the project on the flooding characteristic of the Namoi floodplain, and in particular was looking at the rail spur to develop a configuration of the rail spur that would comply with the objectives and outcomes presented in what was then the Carroll to Boggabri Floodplain Management Plan and that – there's now – will be, if it gets gazetted shortly, the upper Namoi Valley Floodplain Management Plan which is – which has been developed ..... as a draft ..... since 2016, and I'm not quite sure when it will be gazetted. But, effectively, the compliance criteria in the two plans are relatively similar.

I guess the key conclusions of this study are that the mining area is located beyond the Namoi River floodplain and that has been defined by that – what we've called an approximation of the probably maximum flood of a flood that's three times the one per cent ..... probably flood. The rail spur that was in the – that we assessed as part of the EIS which included a range of embankments on ballast and elevated structures showed that there was negligible afflux for a range of floods including the five per

cent and the one per cent as well as the historical floods because the Floodplain Management Plan actually refers to two historical floods as their reference floods. There's a 1984 – or 1971 and 1955.

MR HANN: Could I just ask a question - - -

MR ROADS: Yes.

MR HANN: - - - which goes back to an earlier question for Brian. Did you do any modelling of alternative locations of the rail spur, for example, because Brian, you said that to consider a relocation of the rail ..... for example, in another – to the south east, there were problems from a flooding point of view of ephemeral and particularly the – or intermittent streams.

MR ROADS: Since 2011, I've probably assessed maybe seven, eight, maybe nine different configurations of a rail spur, including alternative locations.

MR HANN: Right. Okay.

MR ROADS: I think the ultimate alignment comes back to minimising impacts as well as obviously community concerns and addressing those community concerns.

MR HANN: Okay.

MR ROADS: So it has been a long drawn out process.

MR HANN: Sure.

MR ROADS: Expensive too, Brian.

MR COLE: I agree.

MR ROADS: Yes, so effectively the alignment that we've come up with and the configuration that's in the EIS, it showed that there was negligible afflux, as in, it didn't increase the flood levels upstream; negligible change in velocity, because most of the – it was an open structure with the superstructure sitting above the flood line, and more importantly for these big wide floodplains, is it doesn't change that distribution of flow, and that's what farmers are particularly concerned about out there. This picture just gives you an indication of the flood depths. You can see the depths over there on the right-hand side for the – I think this is for the probable maximum flow, about three times one per cent ..... flood.

And obviously you've got the deeper flows with the river and fairly shallow flows across the western floodplain. The eastern floodplain is a little bit deeper and also comes in – with Stratford Creek come in on the southern part of the mine. We also modelled the – what's called South Creek which runs along the western – the eastern boundary and drains into Stratford Creek. And we also did modelling of the Driggle

Draggle Creek to the north which is not shown on here to get to define the extent of those local catchment flood conditions as well.

Yes, and, as you can see there, the rail spur is obviously impacted by flooding but the other infrastructure on the mine is not impacted by the Namoi River flooding at all. There is some infrastructure associated with South Creek flooding. So this is the configuration that we used in – that we went with in the EIS. So the majority of the alignment was on an elevated structure and by an elevated structure – so there's piers with the superstructure sitting above the one per cent AEP flood and we had some embankments where we felt they – they were inappropriate in that location of the embankment just to the east.

It's actually quite a high spot there which you might be able to see from the previous slide. In here – so it's actually quite shallow so we was thinking maybe we could get away with an embankment there. So that's the configuration we run with. There was a few culverts coming through here for the water that would flow through this section of the embankment but that was what we went with. So that just gives you a conceptual view of what the alignment was – the elevated section was going to be so that's the piers spaced a regular distance apart with the superstructure sitting above to allow the flood water to go through. The flood modelling that we did – and this is the results showing the afflux or the impacts on water levels for the – the one per cent AEP flood.

And this just showed basically where that embankment is that there is a slight bit of afflux around those embankments but really the elevated superstructure sections are – there really was no change, no afflux. The water was allowed to flow through relatively easily. And that has really required not just afflux which is not super-important – it's more that it doesn't change the distribution of flow downstream. The locations of the afflux are all on Whitehaven owned land as well. As I said, the design of that was based on meeting the requirements of the Floodplain Management Plan for both the 2006 plan which is the one that's currently in place as well as the 2016 draft.

Since we've submitted the EIS, Bis has decided – Whitehaven has decided to elevate that rail spur section west of the Namoi River just basically on a constructability consideration as you get an elevated – elevated structure – elevated structure and then there's a small section in the middle so they thought, well, let's just get rid of that and put it all on – as an elevated rail spur. Obviously the final height and the size of the spans, the piers and all that sort of things will need to be undertaken during detailed design and that design will be undertaken in a consultation with OEH. As I said, Royal Haskoning undertook the peer review. They – their comment was that the assessment was undertaken in using best practice techniques.

The department's peer reviewer, WMA Water, also said that it was undertaken in accordance with best practice. There were a few responses in WMA Water's peer review, mostly more comments than anything else, and we will address those comments in the response to submissions. To the questions – and most of these –

these questions that were – came out of the WMA Water review – this one not particularly – the response to this was about that verbal promise from Whitehaven that the entire rail spur would be under viaduct across the floodplain.

Now, there might not – there might be some little sections. As I said, the east of the river, that section potentially could still stay there but I reiterate that the objectives of this rail spur are to meet those objectives of the plan and that's to minimise the – minimise afflux, minimise the distribution of flow so that's what we're aiming for in the design rather than just saying well, we're going to get rid of the – all – all the embankment sections.

The west of the rail spur would be elevated above the one in a hundred year or one per cent AEP level except for a small section where the viaduct transitions to the main one. Obviously, we – you need to have some sort of embankment right next to the existing rail line and it may include an embankment to the east of the Namoi River but then again that will be on Whitehaven owned land. The sensitivity of the incremental flood levels above or below that would occur without the rail spur at the CHPP and the junction with the north-west main line to change any floodplain hydraulics.

As we – as I've said before, the CHPP is actually located outside the extended flooding from the event that is three times the one in a hundred year design flood event and again that north-west main line is not overtopped at the junction with the rail spur either for that extreme flood event. This is a 13 kilometre wide floodplain so just to try and give you an indication the levels are not sensitive. When the flows are confined and they're deep then they're – then those – the mannings or the roughness values can make a big impact on flood levels. But once you've got such a big broad floodplain that's flowing very slow they're just not that sensitive. The difference in flood levels between the one per cent and the three times one per cent is really only point eight so it's not very much.

On that basis even if we increased the roughness values above what really the calibration values said that they should be, the CHPP and the north-west main line at the confluence is not going to be overtopped; it's not going to be inundated by – at all. Now, what's the sensitivity of the incremental flood levels if the peak discharges for the local tributaries are – all occur at the same time. I guess the Stratford Creek comes in – now, it's 250 square kilometres compared to 9000 square kilometres of the Namoi River so the chances of those two catchments peaking at the same time would mean you would have to have a very, very significant regional event that occurs over two or three days; and then, as that event comes down and then it peaks at the river, you need to have a thunderstorm event over a number of hours of the same AEP coming down.

So the likelihood of those two events which are completely different meteorological mechanisms as well occurring at the same time is actually very, very low. Notwithstanding that, the Stratford Creek and the Collygra Creek discharges combined – it says two and a half per cent there; it's actually two and a half per cent

from Stratford Creek and about the same from the Collygra Creek so even the combined, it's only a five per cent increase in discharge at the rail if that very unlikely scenario happened, so five per cent. As I said, there's very little difference in flood levels between an event that's three times the one per cent so a five per cent increase in levels in discharges has a very, very minor increase in peak flood level across the floodplain.

MR HUNT: Excuse me, can I just interrupt. That's actually a correction on that slide – see it says 2.5 per cent.

MR HANN: Yes.

MR HUNT: We only discovered that this morning. Is there a way that that should be formally corrected before being placed on the Commission's website or is - - -

MR HANN: David, how do you want to manage that?

MR HUNT: - - - the transcript enough in itself that - - -

MR WAY: I will touch base with Brian and my ..... after the meeting.

MR COLE: Yes. No. Thanks, John.

MR ROADS: Yes, so that's basically all I have to say on that. It could happen but I guess the other thing that is – is that if the events did happen at the same time then the event at the rail spur from – along the Namoi River would actually be an event more severe than the one per cent AEP event.

PROF WILLGOOSE: That assumes that they are driven by independent storms. If the thunderstorm is embedded in a bigger event – okay – then the likelihood is not one in a hundred years times on 100 years; it's something more frequent than that so - - -

MR ROADS: Yes. Yes, was not more than 100 times 100 but - - -

PROF WILLGOOSE: Yes. Yes.

MR ROADS: But the dominant flood levels across the floodplain are dominated by Namoi River flows. So if you did an annual series flow frequency analysis of all the flows from the Namoi River that would include all of those flows coming in from Stratford Creek as well so - - -

PROF WILLGOOSE: Sure.

MR ROADS: - - - if you did do that and then added on top of it you would have an event that would be slightly larger.

PROF WILLGOOSE: Yes. Fair point.

MR ROADS: I think that's all I've got.

MR HANN: Thanks, Greg.

PROF WILLGOOSE: Can I just ask one minor question.

MR HANN: Yes, of course, Garry.

PROF WILLGOOSE: I mean how much – that – where the – you said that the – going back to the flood levels, right, the – I think it was the first slide that you had.

MR ROADS: Depths. I've got a depth one.

PROF WILLGOOSE: Yes, depth. That's the one I'm interested in. Yes. Okay. There, so you said that at the one – the three times event that the area where the rail link takes off from the main western – main north-western rail line is not flooded but it actually got - - -

MR ROADS: No, it has flooded but the north-west rail line is elevated. It's on a - - -

PROF WILLGOOSE: Okay. Okay. Yes.

MR ROADS: It's nearly two – a metre and a half above.

PROF WILLGOOSE: Okay. So then the question - - -

MR COLE: Well, it would be three metres actually, I reckon.

PROF WILLGOOSE: Okay. Yes. So then – okay – the follow-on question from that is how much of the rail link is going to be embankment before you go onto viaduct? I mean, because certainly, you know, what you've shown has no increase in affluxes there. I mean, someone at the public event who lives locally that was concerned about that, I would think – it sounds a reasonable question to respond to is given all of that and, okay, yes, it might be a fairly localised piece of embankment, what would be the - - -

MR ROADS: Well, as short as possible is the answer to that, Garry. I mean, remembering that, of course, it's the – the turnout belongs to the AATC so you will need to have some embankment there. Yes.

PROF WILLGOOSE: Sure. That's – that's right.

MR ROADS: In the modelling I think we might have used 20 metres or something.

PROF WILLGOOSE: Okay. So a really minimal amount of it.

MR ROADS: Yes.

PROF WILLGOOSE: You almost go straight onto the viaduct.

MR COLE: Yes, that's the idea.

PROF WILLGOOSE: Okay. Okay.

MR COLE: I've had the AATC out looking at it and, yes, they were more than happy with the – with the location and that it was workable but, you know, it will be one of those things that you work through with them.

PROF WILLGOOSE: Okay. Yes.

MR HANN: We might take, say, a five minute break, probably in the best interests of everyone.

MR VAN MAANEN: Delicately put.

RECORDING SUSPENDED **[11.37 am]**

RECORDING RESUMED **[11.49 am]**

MR HANN: Okay. We might – we might start up again.

MR COLE: Okay. Well, Aleks will cover air quality.

MR TODOROSKI: All right. Okay. So my name is Aleks Todoroski. I have over 25 years experience in air quality. I've looked at hundreds of new and modified mine approval projects in that time. I'm currently the director of Todoroski Air Sciences and prior to that, I held senior and management level positions in the air branch of New South Wales EPA. I've conducted many peer reviews for the Department of Planning and Environment and I conducted the peer review of this work which was done by Ramboll. The aim of the assessment report is fairly simple. It's to predict the potential air quality impacts, prepare them with criteria, but also to examine the appropriate mitigation measures that may be necessary.

The conclusion in this case is really quite clear cut. It shows compliance with all criteria at all of the privately owned receptors, and I will go to it in a little more detail later. The modelled air quality controls that were included largely around haul roads and consistent with industry best practice. So that's a 90 per cent level of control. The use of larger vehicles for hauling. That reduces the number of trips, but it helps

to reduce the – also helps to reduce turbulence on the road surface when the tracks are higher up. Restricted speed limits on haul roads, progressive rehabilitation of disturbed areas which is to minimise the footprint of loose material and, hence, wind erosion and similarly, minimisation of pre-stripped areas. Sprinklers at the coal handling and preparation plant, you know, reduce wind erosion and handling emissions as well.

The predicted results, again they show compliance with all of the key metrics at all of the privately owned receptors. The key metrics you really need to look at for the design of the mine air annual emissions, the 24 hour averages are governed by the background level, so things like bushfires and dust storms will, of course, effect those. The transport of coal by rail, diesel emissions and blast emissions were specifically looked at and no adverse air quality impacts were predicted there as well. The issue of Boggabri was also raised. Now, Boggabri is 15 kilometres away from this project. It's simply too far for any tangible impacts of air quality to occur at that distance.

In terms of operational monitoring, there would be a real time proactive air quality management system. Now, that includes meteorological forecasting and monitoring to identify a potentially adverse condition, Also, real time dust monitoring which is normally a 10 minute cycle and that triggers alarms that can be sent to the operator. Now, the trigger levels are set well below criteria generally and they often use shorter time metrics to enable the operator to respond in time to know what's going on. All of the management practices and monitoring is documented through the air quality management plan for the site. That's where that system more or less resides.

The next part is more detailed with the questions that IPC raised. Now, it's important there's – some of these questions were quite needed – you know, quite a considered response, so there will be a written response. This is really just the summary of those key points. The first point was about traffic on local unsealed roads. The key issue there is that access to the project is on sealed roads and not on unsealed local roads. The terms of engagement of employees and contractors actually prevent them from using those unsealed roads.

The use of local unsealed roads by the project would be quite infrequent. There is the need occasionally to go to a monitoring station for calibration, that type of thing. Because it's so infrequent, that's quite an intangibly small thing. It's worth mentioning that any, you know, significant dust from existing local roads would be captured in in the background data that feeds into the cumulative assessment that Ramboll did there.

The next point there is about modelling assumptions and outputs comparing it to the mine. Now, this is best done with graphics and tabled results and things like that. But the key points there are that for both the project and the approved mine, the annual emissions are estimated based on the peak years of moving waste rock and coal, but also the largest exposed areas for wind erosion and most importantly proximity of that activity to the receivers.

MR HANN: Aleks, can we just - - -

MR TODOROSKI: Sure.

MR HANN: A question in terms of peak year. Looking at the data, it also looks like year 16 is by, a tiny margin, the peak year for handling, but the important thing is that it's compared to, say, year 21, the overburden in placement is still substantially underway. You would expect there to be less vegetative cover progressively then. So the question is – is year 16 potentially a worse case year?

MR TODOROSKI: You can actually see that by looking at the assessment. Each year has got the incremental impact shown.

MR HANN: Right.

MR TODOROSKI: And then in the columns to the side of that table, you will see the cumulative impact as well. So it's tabled in the actual report.

MR HANN: Right.

MR TODOROSKI: So given you've raised that, we will specifically make sure - - -

MR HANN: Yes. No. That would be helpful.

MR TODOROSKI: - - - year 16 is looked at - - -

MR HANN: No. Thank you.

MR TODOROSKI: - - - in that written response.

MR HANN: Okay.

MR TODOROSKI: We can do that. That's going to flow into my next point actually, but that's fine. So where were we? The key difference when we compare this project and the approved mine is to do with the treatment of haul roads. Now, there's quite a large difference there in this mine is doing 90 per cent which is considered the best practice level. Previously, it was 75 per cent. Now, that's more than halving the dust from the dominant source of emissions. So there's quite a shift there. Haul roads are the most significant contributor to the dust.

The reason this comes about is that since the approved mine came into place, it had a dust stop program, all of the mines responded to that and investigated and quantified the level of control they had on haul roads. Most of the mines, coal mines, were achieving 90 per cent or higher. All of the Whitehaven mines, including the local mines, were achieving 90 per cent or higher haul roads and, hence, that's why we've used 90 per cent haul roads or Ramboll used 90 per cent controlled for these haul

roads. Further details and comparisons and things on this question will be provided in the response. It's better to show it in tables than I can explain in any event.

PROF WILLGOOSE: So when you have 90 per cent control of the haul roads, does that mean that other dust sources then become dominant?

MR TODOROSKI: The haul roads are still pretty much the - - -

PROF WILLGOOSE: Okay.

MR TODOROSKI: - - - major source, even with that.

PROF WILLGOOSE: Okay.

MR TODOROSKI: But if you look at – if you're going from 75 per cent control, a 25 per cent is what's being admitted to 90 per cent or 10 per cent is being admitted, so 60 plus per cent reduction.

PROF WILLGOOSE: This is why I asked.

MR TODOROSKI: It's quite large. Yes.

PROF WILLGOOSE: You know, because that's significant enough reduction that other things might – blasting may well be more important - - -

MR TODOROSKI: They do. If you look at the inventory, they have some things in the report where they, sort of, graphically show that. You will see there's extra coal coming in, so you see coal is slightly higher on this one are typical. But that's what you would expect because that's what they show. Anyway.

MR HANN: So just to be clear – so did Ramboll use the – for the approved mine in the modelling for that, did they use 75 per cent or 90 per cent?

MR TODOROSKI: 90 per cent.

MR HANN: They used 90 per cent for that as well. Okay.

MR TODOROSKI: Sorry. Sorry. The approved mine is 75 per cent - - -

MR HANN: Yes, that's why I - - -

MR TODOROSKI: My mistake.

MR HANN: Okay.

MR TODOROSKI: For this mine, it's 90 per cent.

MR HANN: Right.

MR TODOROSKI: The next thing was around the worst-case scenario.

MR HANN: Yes.

MR TODOROSKI: Now, we will explain that - - -

MR HANN: Please.

MR TODOROSKI: - - - but in essence, when we use that term inequality, we're talking about a scenario or year where the maximum likely impact would arise. We look at three scenarios in this case. They're based around examining the maximum amount of movement, that when you – whenever you move material, you generate dust and it's directly proportional to the quantum, but it's also proportional to the size of the exposed area and that generally, after about three months, you get some rain and things tend to stabilise more. But the other main one is how close this is to the source. That's really the – one of the primary things you're meant to look at. Because the mine activity moves around at the time and the receptors fix them as a number of groups, you need at least three scenarios to make sure you've captured that worst case of all receptors for all scenarios.

The next question was about calibrating the model with existing mines. Now, it's quite unusual to do this for air quality, especially – so, in this case, the nearest mines are actually quite a way away. They have significantly different terrain. They've got significantly different land categories with the forest there and the ambient monitoring data includes the dusts from, you know, the farms and all the other local sources. You can't exclude that. Unlike some of the other environmental models, the air quality dispersion models, you use a regulatory-approved dispersion model. They're designed to not underpredict.

The key thing you need to look at is the emissions inputs that are put into the model. In this case, a regulatory model ..... were used. They have been extensively validated by the US EPA and use a synthetic tracer gas to do that. It's quite damaging to the environment to do that and so that – these models have proven that they do not underestimate impacts, provided, you know, you put reasonable emissions in. I did the peer review of those inputs to the model and they're quite consistent with a normal mine. There's nothing unusually high or low about it, as I mentioned earlier. Slightly larger fraction of coal because there's coal coming in for processing. The other question that was raised - - -

PROF WILLGOOSE: Before you move on there, I guess the context for that question was – you know, and I – none of us know – have been able to test the validity of the public comments about dust exceedances at other Whitehaven mines and so the thought was, well, it is suggested, at least in terms of the public comments, that the mines were underpredicting, in some form or other, dust impacts

because there were assertions of the dust impacts were worse than what were projected in the EIS and that sort of thing, so.

MR COLE: That's not what the EPA have found.

PROF WILLGOOSE: Yes. That's right. That's why I say I put that – I – we don't know. I – we were just asking the question. Obviously, can they be calibrated to – yes.

MR TODOROSKI: They tend to overpredict.

PROF FELL: ..... one of the things that came over to me ..... was the real wish .....

MR TODOROSKI: I've got a - - -

PROF FELL: Now, for no better reason than to satisfy them the situation is as you've predicated, would ..... support of that or?

MR TODOROSKI: I've got – that's my – that's one of the questions that I'm - - -

MR HANN: Okay. You will address that? Okay. Thanks.

MR TODOROSKI: And I've actually got more extensive dot points on that.

PROF FELL: Okay.

MR HANN: Thanks.

PROF FELL: My apologies for jumping ahead.

MR TODOROSKI: That's okay. ..... but, look, I will take that and make sure I elaborate on that in the written response.

MR HANN: Yes.

MR TODOROSKI: The next point was about agricultural activity and particularly cotton. Now, that was considered in the agricultural impact statement.

MR HANN: Yes.

MR TODOROSKI: Two papers in there in particular: the '92 paper looked at cattle feeding on ..... contaminated with coal dust. In fact, those levels are very, very high. You can almost sweep that up and it found they're quite insensitive to that. The '93 study looked at effects on vegetation. It found the threshold at about 15 grams per square metre per month. The sorts of levels we're looking at here are one gram per square metre per month, and that's at the most impacted point receptor. That's 127B or C, the one just across the river there. In terms of coal dust potential to discolour

the cotton crop, the fraction there is – it's approximately 0.3 grams per square metre per month and that's – it's a very low number. That's quite unlikely to be tangibly noticeable .....

PROF WILLGOOSE: So point 3 is how – what are – what – how is that relative to the background?

MR TODOROSKI: The background level is about 2.8 in this area for all dust.

PROF WILLGOOSE: So you're looking at about 10 per cent of the background?

MR TODOROSKI: Roughly 10 per cent of the background and that's at the most impacted point. It's actually lower as you go further away and I'm also assuming the coal is sort of more focused in – around the ..... closer to the receptor ..... it would actually be lower. The next issue was covering the coal wagons. Now, this issue has been looked at quite – quite a lot of studies have looked at this both in New South Wales. There has been some excellent studies in Queensland, but also studies in Portugal and other countries. All of those studies conclude that there's no tangible risk of impacts occurring from that. The cost and logistics of covering wagons is multi-billions of dollars. It involves changing an entire network to accommodate ..... all the infrastructure has to change and it's just not reasonable in the context of no likely adverse impact arising.

PROF FELL: Can I just ask a question on that there.

MR TODOROSKI: Of course.

PROF FELL: You're talking ..... shift away, there has been a number of projects now talking about covered rail for transport. I just wonder if the conclusions remain the same when you shift from road to rail.

MR TODOROSKI: The truck activity generally generates more effects than moving to rail. There's a few reasons for that. The trucks, when there's – when they're loaded, they're loaded with front end loaders, things like that, which generates more dust at the source. Coal wagons are loaded through a bin. You get a nice, uniform profile of the coal load. The rail transport is much more efficient and lower impacting than having trucks, not to mention all the other things like road safety and all those sorts of things, but just even on dust alone, there are efficiencies in moving from truck to rail, that it is for the trucks vibrate ..... so there's a whole bunch of things. The only place that I know that are covered rail wagons is in the northern parts of the US and they do that because the wagons can freeze and it can actually break the wagons. They can fill with water and freeze, so they have to – it's not about keeping the dust in. It's about keeping water out.

PROF FELL: Just as a point of information, the Hume Coal EIS is proposing covered coal wagons for the very reason of dust.

MR TODOROSKI: I would have to look at that more closely.

PROF FELL: It's available through the EPA website.

MR TODOROSKI: We will take that ..... well, bearing in mind that wagons are recycled through the industry.

PROF FELL: Sorry. I missed that.

MR TODOROSKI: Wagon – the coal wagons are recycled. I mean, we don't have dedicated - - -

PROF FELL: Yes.

MR TODOROSKI: - - - wagons to a particular mine. They're - - -

MR HANN: It's a pool that recycles - - -

MR TODOROSKI: They are a pool. Yes.

PROF FELL: Can I simply say the EIS is quite specific. They will use covered coal wagons.

MR TODOROSKI: And so is the testing. It's quite specific. There's no impact.

PROF FELL: Please, on – sorry. I will say no further. I'm simply interested in your reaction.

MR TODOROSKI: Look, I'm really interested in that proposal myself, so we will certainly look at that.

MR HANN: Okay.

MR TODOROSKI: The next one was the – your earlier question about establishing a station at Boggabri. Now, I think earlier I mentioned Boggabri as approximately 15 kilometres from – from the project. Now, that's way beyond any potential tangible level of dust from the project, but the key points here are – there is an extensive regional monitoring at work already in place. The Office of Environment and Heritage has monitors at Narrabri, Gunnedah, Tamworth, Maules Creek, Breeza and Wil-gai.

Wil-gai is the monitor nearest the project site and it's included in that network. Those data are reported weekly on the EPA website. The latest summary report that the OEH has says that dust levels in the Namoi region are very good, good and fair, which means below the criteria, 97 per cent of the time. And it attributes levels above the criteria to dust storms and winter wood smoke. So these are the 24 hour levels. So the dust storms have been fairly extensive with the drought at the moment

and winter wood smoke would relate to the monitors that are in town, and it relates to pm 2.5.

PROF FELL: A question that may be of interest to the residents of Boggabri, would this information on your monitoring system be made publicly available, much in the way that the water authorities make the information publicly available?

MR COLE: It already is, Chris. Wil-gai is part of it, as – as Aleks said, as part of the government – it's network, which is currently published, and I guess the – one of the – the main people within Boggabri that was promoting the – the monitor in Boggabri is part of that committee. So she already sees it.

PROF FELL: Okay.

PROF WILLGOOSE: So where – where is Wil-gai relative to the project site?

MR TODOROSKI: Slightly north – north-west.

PROF WILLGOOSE: North, north-west, and Boggabri is more or less west?

MR TODOROSKI: Yes. It's - - -

PROF WILLGOOSE: So – so there is an issue that it would be sampling when the winds are coming from the south-east, whereas Boggabri would be impacted when the winds are coming from the east.

MR TODOROSKI: Well, I don't think that Boggabri will be impacted but I'll - - -

PROF WILLGOOSE: No, no, no. I just – I – I raise that as, you know, to - - -

MR TODOROSKI: It – the – the monitors on the – sort of the dominant, prevailing wind direction.

PROF WILLGOOSE: I – I – the reason I mention that is because I know, in Singleton, that people are asserting that the worst dust impacts are when they come from directions that are not monitored, you know. Now, I don't know the truth of that but that's what people are saying.

MR TODOROSKI: Well, I – okay, I'll – at the risk of into other people's issues, but there are 168 dust monitors in the Hunter Valley.

PROF WILLGOOSE: Yes, yes.

MR TODOROSKI: It's the most – the most monitored place on the planet for dust - - -

PROF WILLGOOSE: Yes.

MR TODOROSKI: - - - that I'm aware of and I think it's very well covered, but I'll - - -

PROF WILLGOOSE: But - - -

MR TODOROSKI: - - - I'll leave it at that.

PROF WILLGOOSE: Yes.

MR HANN: Okay. Thanks, Aleks.

MR TODOROSKI: But, look, there – there's – there are a few more points here to cover and I think, then, maybe if we cover them, we can – we can have the discussion - - -

MR HANN: Sure.

MR TODOROSKI: - - - but so the – the short term levels that are above criteria arise because of dust storms and things like wood heaters in the town, in – in the winter time. It's important to note that they're not attributable to mining activity. The OEH network is in addition to – there are numerous mine-specific monitors closer to the mines for compliance purposes. I think I've already explained Boggabri is really just – it's 15 kilometres. It's just too far to be able to tangibly measure the – any contribution from the mine there. Instead, you – dust will be measured at – at a location closer to the mine, where you – you actually would be able to pick up a signal from the mine, and you should be able to quantify what its contribution is. You should be able to assess compliance at that point and you can infer compliance further out. And I take what you're saying, there are some prevailing wind directions. You can see them in the wind roses and they do bias things. You can see in the back of the report the contours there have different shapes that – and it's governed by the wind – wind directions. And that – that's about it.

MR HANN: Yes.

MR TODOROSKI: That's all I have.

MR HANN: Aleks, I've got a – just a couple of questions. It really goes to scale and the – the incremental difference between what's approved and the extension that we – we're focussed on. And in terms of air quality, so – and we heard this, Brian, a number of times, as well, in submissions at – at the hearing. It's not surprising. Given the significant change in scale, and yet, say, taking the annual average pm 10 and pm 2.5, the – the results are not that dissimilar. They're quite – you know, if I – if I look at those and I go, there – there's not much in it, and you – maybe you – you touched on this earlier, when you talked about perhaps how the modelling was done for – in terms of road haulage and – and dust management from road haulage, because 90 per cent – 70 – 75 per cent, okay, is quite significant and yet, it's a big

contributor, clearly to airborne dust. So it's an open-ended question, really, to say - - -

MR TODOROSKI: Yes. Well - - -

MR HANN: - - - I feel that I need more understanding of how the dust is, if you like, kept at a level similar to a four and a-half million ton per hour operation, versus 10, together with the additional material movement around the coal handling plant and – and imports.

MR TODOROSKI: So there's – yes, I mean, the – the key – key factors are the emissions inventory, which I – I've talked about. Other factors are, you know, the – the models are more – more sophisticated, more accurate now. So they over-predict by less, if that makes sense. And generally speaking, you know, if you're doing some of these models, you use very conservative assumptions. So all of that will – we'll explain in – in the response. I think that point about the model assumptions and comparing things in there, we'll provide that in the – in the written response, but I – I take on board what you're saying and it is that the incremental effects due to the mine are relatively similar to the previous one, yet we've doubled - - -

MR HANN: Yes.

MR TODOROSKI: - - - the coal production.

MR HANN: Yes. Yes.

MR TODOROSKI: But that makes sense - - -

MR HANN: You just take your – the basic key criteria, you know, the pm 10 cumulative - - -

MR TODOROSKI: Yes.

MR HANN: - - - annual average and you – I – I've just noted, you know, 19 versus 19.9 for, say, one of the receptors.

MR TODOROSKI: Yes.

MR HANN: You know, there's not much in that, and if you look at the 2.5, it's – it's 6 versus 7 or something like that.

MR TODOROSKI: Yes. Yes.

MR HANN: So you go, gee, that's – that's - - -

MR TODOROSKI: It is similar.

MR HANN: That's an interesting result, given the quantum change in – in what's proposed.

MR TODOROSKI: Yes. And I guess we'll provide more detail around that in the written response. But as I said, the key things are that the quantum of dust being emitted is substantially lower.

MR HANN: And that's due to the – the haul road management.

MR TODOROSKI: Haul roads is – is one of those things - - -

MR HANN: Is – is a primary one, is it?

MR TODOROSKI: It's - - -

MR HANN: Okay.

MR COLE: Just - - -

MR TODOROSKI: It's also the design of the mine.

MR COLE: Just to give you a bit of context, John, in regards, though, to Maules Creek, and how does this – what does this extra efficiency that's been built - - -

MR HANN: Yes.

MR COLE: - - - into the model, how – what does it mean? It means probably two to three times the water trucks that would have been used previously.

MR HANN: Right.

MR COLE: You know, at Maules Creek there's probably seven or eight water trucks running around continuously. Now, the expectation going into that mine would have been, well, two or three. So the – the world has changed - - -

MR HANN: Yes.

MR COLE: - - - dramatically.

MR HANN: Yes. Okay.

MR COLE: And it needed to.

MR HANN: Yes.

MR COLE: So when that's translated into the – the current practice that's used, in terms of dust generation, fed into the model, out comes the result that you can see.

MR HANN: Okay.

MR TODOROSKI: I think – you know, and there's been large changes over the years. I mean, I think one of the benefits of the Hunter Valley is you have two large towns in amongst coal mining activity – quite a lot of coal mining activity – and there's huge regulatory pressure to improve there, to the point where some of the systems that have been developed, you know, I talked about some of the predictive systems and real-time systems. They're now – we're now being approached by the US authorities to make these systems mandatory in the US. Previously, the US was the benchmark for – for what you do. Now, they're looking to the Hunter Valley. That's taken as standard practice across the Hunter Valley. It's an expectation rather than something special now. And that's progressed very rapidly in the last, sort of, five to 10 years – very rapidly, in fact – the understanding and ability to control dust.

PROF WILLGOOSE: Yes. Well, I think what John is, it would be good if the – if the report was a little bit more explicit about, you know, sort of, the relativities of the sources and the modelling. You know, I mean, an obvious sort of thing would be – you probably don't want to do this, but would be to run, for instance, this with the Vickery 2014 assumptions and show that, well, if – if we use what was there but this has now been improved by this, this, this, this, and that's why the numbers have not changed. So that's a lot – I'd say, a lot clearer - - -

MR HANN: Yes, yes.

PROF WILLGOOSE: - - - about the ..... rather than, well, we've just improved things - - -

MR TODOROSKI: Yes, no, no - - -

PROF WILLGOOSE: - - - if you know what I mean.

MR TODOROSKI: Yes. No, no. Okay. I can think of ways to answer that question.

MR HANN: Yes. No. No, thanks.

MR TODOROSKI: Okay. It's good to know where it's coming from. Helps to answer it.

PROF FELL: Again, something that came up was blasting - - -

MR TODOROSKI: Yes?

PROF FELL: - - - and scheduling thereof etcetera, and matching it to atmospheric conditions. I'm sure you have instructions on that, but can you just quickly go over them.

MR TODOROSKI: I don't have instructions on that.

PROF FELL: A number of people were concerned about the - - -

PROF WILLGOOSE: Because – that's right. Certainly the Hunter is becoming quite sophisticated in terms of timing of blasting with whatever predictions and those sort of things.

MR TODOROSKI: Yes. So we – my company does a lot of the predictive systems for many of the mines in the Hunter Valley specifically for that. The pattern is very predictable, in fact. It – as long as you blast some time after 10 o'clock and before 3 o'clock, it's generally very safe. You can nuance it a little because many of the Hunter mines have receptors very close to – there may be a public road, for example, that may need to be shut down.

PROF WILLGOOSE: Yes.

MR TODOROSKI: So they do use predictive systems to control exactly when that timing happens. Some of those mines, the larger mines that might take days physically to actually put the explosive in the hole, they will actually look for a window when they finish loading the shots so they can blast as soon as possible. The risks from fumes from blasting come from when there's heavy rain, delays and so on. So those systems are being used by ..... but look, by and large, this mine is fairly isolated from other mines, so it's fairly – it's not going to be constrained by what your neighbours do so much. It's quite a minimal risk for them, and generally speaking as long as they're blasting in the daytime, there's no large .....

MR COLE: Chris, it's standard practice that in terms of setting a blast off, there are limits on wind speed and direction.

MR TODOROSKI: Yes.

MR COLE: Standard practice these days. Yes.

MR TODOROSKI: Sorry. I should have done the more simple – sorry.

MR HANN: Any more questions on air quality, blasting .....

PROF WILLGOOSE: No.

MR HANN: Thanks very much.

MR COLE: Okay. Well, we'll move on to noise, and John will cover those issues.

MR HANN: Thanks.

MR COLE: First and foremost, a refresher on what he did last time, and then address the questions specifically.

MR WASSERMAN: If I forget to move the pages, just remind me. I have a habit of doing that. Okay.

MR VAN MAANEN: Just check that – sorry, Chris. Before we proceed, it's okay if we go – we might end up going a little bit over - - -

MR HANN: That's fine.

MR VAN MAANEN: - - - but is that okay from your perspective?

MR HANN: Yes. Yes, no, we're fine. No, we're - - -

MR VAN MAANEN: I just want to – we're conscious that we need to kind of move things along, but - - -

MR HANN: We appreciate it. No, it's good to have this in-depth discussion.

MR VAN MAANEN: Yes. I think so, yes. Okay.

MR HANN: If your program works for that as well.

MR VAN MAANEN: Yes. Certainly fine from our perspective.

MR HANN: Okay. Thanks.

MR WASSERMAN: Okay. So this little presentation is with regard to noise – the noise and blasting assessment. Okay. By way of introduction, my name is John Wasserman. I'm a director of Wilkinson Murray. I have over 25 years experience in acoustics and vibration. Prior to being a noise consultant, I was manager for the noise assessment for EPA, and I've worked for the Department of Planning in the assessments area. So I've got sort of experience in both consulting and regulatory sides.

Wilkinson Murray was engaged by Whitehaven as the principal acoustic consultant for the Vickery expansion project to prepare a noise and blasting assessment. To be sure that the noise and blasting assessment was well done and considered all the issues, SLR was engaged by Whitehaven to undertake a peer review. Specifically, Glenn Thomas was commissioned. Glenn, again, has over 25 years experience in the assessment of noise from coal mines, and he's done numerous reviews, peer reviews, on behalf of the Department of Planning.

The main objectives of the noise assessment were to identify reasonable and feasible mitigation so that these could be adopted in the noise model. The noise model was used to predict noise levels at sensitive receivers and compare the predicted noise

levels to criteria specified in various noise policy documents. The key conclusion of the noise modelling was that there would be no additional noise affected properties compared to the approved mine. For blasting, the objectives of the assessment were to confirm compliance with human comfort and building damage, criteria at dwellings, and confirm compliance with building damage criteria at heritage sites. The blasting assessment concludes that compliance with criteria can be achieved. Whoops – what happened there – there we go.

The impacts presented in this report presented a sort of culmination of an iterative approach designed to determine feasible and reasonable noise mitigation measures. The steps used in this approach were preliminary noise modelling of scenarios representative of maximum noise emissions, evaluation of various combinations of noise managing and mitigation measures, review of the effectiveness of these measures and assessment of their feasibility, and then adoption of the reasonable management and mitigation measures by Whitehaven for the project.

As a result of this iterative approach, modifications to the mine plan were undertaken in order to improve acoustic performance. The – I guess the key reasonable and feasible mitigation to be adopted for the project was the procurement of a low noise ..... the model sound power levels are based on data from measurements of existing mine equipment. Also there have been significant technology improvements in noise performance of mining equipment in recent years.

MR HANN: Is that since the – because I think your firm did the modelling for the current approved - - -

MR WASSERMAN: That's right.

MR HANN: ..... so that's subsequent to that. The - - -

MR WASSERMAN: Well and truly subsequent to that.

MR HANN: Okay.

MR WASSERMAN: I mean, again, the regulators have pushed sound power level of equipment down over the last number of years.

MR COLE: You heard what was said by the guy from WesTrac at - - -

MR HANN: Yes. Yes.

MR WASSERMAN: So other important mitigation measures are the treatment of a selection of mobile plant and infrastructure items to reduce emitted noise levels. So there are some specific mobile plant that will be reduced. Refinement of the waste rock and placement and mine progression to provide opportunities for shielding of operations.

MR HANN: Will you elaborate on that later, John, or is it something to do now?

MR WASSERMAN: It's – again, this is – this is probably – there are further parts of this presentation that discuss that.

MR HANN: Okay.

MR WASSERMAN: But at the end of the day, it's best done by figures. So, again, a lot of those things will be elaborated on in the written response.

MR HANN: Okay.

MR WASSERMAN: Okay. So now, just for a summary of the noise assessment. So the noise criteria adopted for the assessment are the most stringent that can be applied under the noise policy for industry, with the adopted mitigation measures in place, compliance with criteria is predicted at all privately owned receives except at three closest properties identified as 131, 132 and 127. For properties 131 and 132, only a negligible exceedance as defined by the noise policy for industry are predicted. With this level of exceedance it's likely to be perceptible.

Property 127 is the closest property to the project. The owners of this property have the right to acquisition upon request under the current consent for the approved mine, and it is expected that these rights would also apply for this project as well. So submissions received in the EIS query why there are no significant increase in noise predictions for the project when compared with the approved mine. The main reason is the improvements in noise mitigation technology since assessment for the approved mine. That is, while the project requires an increased number of fleet items, noise performance improvements have resulted in a decrease in the total sound power level of all the equipment.

In addition, the project will reduce noise when compared to the approved mine as the project rail spur will result in the cessation for road traffic noise along approved transport routes, and the cessation of noise from the Whitehaven CHPP in Gunnedah. Additionally, the remove of the approved eastern emplacement will reduce noise impacts for the receivers to the south of the project as well.

Rail noise: the assessment considered noise along the project rail spur with compliance with criteria predicted at all existing private receivers. It should be noted that the noise associated with locomotives idling on the rail loop is also considered and is included in the operation noise modelling results.

Project train, once on the main line, are also separately assessed cumulatively with other trains on the main rail line. Lasting assessment: so, to remove overburden material at the project – the project would be undertaken using drill and blasting. The blasting assessment predicted compliance with human comfort criteria for vibration and overpressure at all privately-owned receivers. In addition, blasting is

not predicted to result in any building damage at the Kurrumbede Homestead with compliance in building damage criteria predicted.

So the operationalised management – so with regard to the management of noise from the mine, it will be managed to its project noise limits, typically specified in a development consent, or EPL. Proactive real-time monitoring – noise monitoring and management would be used onsite. This will include meteorological forecasting and real-time meteorological monitoring to identify potential noise-enhancing weather conditions. Real-time noise monitoring: alarms will be set below noise criteria. Alarms will be sent to mine personnel to review data and manage activities as may be required. Management measures would be documented in a noise management plan.

Similarly, blasting limits are expected to be specific in the conditions of approval. Monitoring of all blasts would be undertaken to confirm compliance with criteria. So now we're going onto the questions. Again, just the – well, it's not the word of warning, but a comment that the written response will provide a lot more detail – so this is just a summary. So the first question, which is a bit of a long question, so I will read it I guess:

> *Questions have been raised about noise-modelling contours and the proponent demonstrated that their approach gives valid results for similar scenarios at their other local mine sites – IE show that they're modelling works. What is the sensitivity of the predictions to changes in the noise assumptions?*

So our response – a summary of the response is that the modelling and assessment methodology under the New South Wales policy for industry is inherently very conservative. Wilkinson Murray has extensive experience in assessment and monitoring of noise from large mining operations. Modelling was conducted using the environmental noise model (ENM) which is a regulatory-approved model, which we believe best models coal mine noise.

Reliable inputs to modelling provides certainty of results, so we try to get the best inputs. So equipment, sound power levels were based on measurements or manufactory specifications. Mine topography and ..... locations were based on 3D mine plans to an accuracy of contours about two metres. Surrounding topography was based on government topographic data or project surveys. And, importantly, the meteorological data was based on data from an onsite met station.

So Wilkinson Murray has conducted noise validation studies for ENM, which have found monitoring to be within one to two dB of the model levels. Again, the written response elaborates on those validations. Maximum noise predictions are for the most adverse meteorological conditions, so the analysis within the assessment suggests or indicates that noise levels would be lower than the maximum for 90 per cent of the time.

PROF WILLGOOSE: So does that mean that from the most adverse meteorological conditions that for 90 per cent of the time it won't be exceeded, or is it - - -

MR WASSERMAN: It will be less than – so we've basically predicted the noise level for a very adverse condition. So for 90 per cent of the time it will be definitely - - -

PROF WILLGOOSE: Okay. For 90 per cent of the time during the adverse conditions?

MR WASSERMAN: Yes. Okay. The assessment in there – we referred to – we did more or less two assessments: one being what we call the P10 assessment, and one being a noise policy for infrastructure assessment. So what we found is when you do it strictly speaking for the noise policy for infrastructure, it is a very worst-case condition. And, typically, that condition that occurs under the noise policy for industry might occur for three per cent, five per cent of the time. So it's – yes.

PROF WILLGOOSE: Okay. So it's 90 per cent of that three per cent?

MR WASSERMAN: Yes.

PROF WILLGOOSE: Okay. That's all I .....

MR WASSERMAN: Yes. Sorry. Okay. Where are we up to? The next question was:

> *Can potential noise from elevated rail spur be ameliorated? For example, sound barriers on a viaduct?*

So we consider that sound barriers are not considered to be reasonable, given that there are no exceedance of the relevant criteria or no exceedance of the relevant criteria are predicted at the existing privately-owned receivers. However, noise from the project rail spur would be minimised by incorporating restrictions on rail speed; measures to minimise rail squeal – so lubrication, more than likely – and the use of best practice rolling stock, including locomotives approved to operate on the New South Wales rail network in accordance with EPLs issued by the EPA.

PROF WILLGOOSE: What was the potential for – I assume it's resonance on a steel structure – the structure to Maules Creek is steel beams on concrete ..... what's the potential for not direct noise from the trains but effectively noise from the viaduct itself when the train is going over it?

MR WASSERMAN: Radiating off. Is it a steel structure, Brian?

MR COLE: Well, it will depend. I mean - - -

MR WASSERMAN: It will depend.

MR COLE: I mean, Gary has said that Maules Creek - - -

PROF WILLGOOSE: The – that's right. The – give you some context to that. A couple of weeks ago, I was standing at the corner of the rail from Southern Cross Station going round to Spencer Street and there's a mixture of concrete viaduct and steel viaduct and the trains going over the steel viaduct generated a lot of noise, but the same trains going over the concrete beams on the viaduct can – generated considerably less, so clearly there's something about the steel beams that generates more noise, irrespective of trains themselves.

MR COLE: The Maules Creek viaduct has special bearings to, you know, potentially minimise that effect. I'm not aware that there's – and they've been checked out, the – they were part of the condition and there has been some noise measurements taken. And I'm not aware that it has been an issue at that particular location. So – and bearing in mind this is going to be much lower profile structure.

PROF WILLGOOSE: Sure. But it might be worthwhile to actually get some real data on the Maules Creek – I shouldn't say "real data" – some monitoring of to see where the major noises are as trains go over the Maules Creek viaduct, just to address that.

MR WASSERMAN: Sure. Okay. I mean, on that, in detailed design, I would suggest that that would be taken care of. I mean, you're quite right: concrete structures radiate a great deal less noise than a steel structure. Most of the small bridges that are being built nowadays here in Sydney are all concrete structures. However, there are mechanisms to minimise noise radiation from steel structures as well, so we will take that on notice and see how we go. Just bear with me. Okay. Where are we up to? This one.

Modelling assumptions, outputs, specifically comparing the approved mine with the extension project, including mine extraction, load haul, operations, CHPP, transport, overburden handling, rehabilitation and inputs from other Whitehaven mines – as described in previous slides, the key difference in noise modelling results is due to significant improvements in mining equipment, sound power levels in recent years, and I was just going to make the comment I believe that this was described in the public hearings by the representative of WesTrac Caterpillar as well just to confirm that. Therefore, the project as proposed has more equipment but the overall site sound power level is less than that was modelled for the approved mine. So there's more equipment, but they make less noise.

So therefore – so as this is a complex issue, a more detailed response will be provided in the written response. Okay. Details confirming the scenarios modelled include worst case – details of worst case definition. So we modelled three operational scenarios to represent the maximum potential for noise impacts. So these scenarios accounted for the proximity of operations to receivers, for example, in year 3 to our receivers to the southwest at maximum elevation topography, so the elevation decreases the likelihood of intervening topography so therefore there's less

barrier effects. The maximum fleet numbers – noise results for all years modelled considered adverse meteorological conditions, so temperature inversions and source to receiver winds.

MR HANN: So of the three years that were modelled, there are none that would generate greater noise?

MR WASSERMAN: We believe not. So again, you need to make a judgment call, but from all the things that we looked at, we thought that they were the worst case. It is juggling numbers of equipment with topography. So modelling of staged infrastructure and handling of imported coal in other Whitehaven sites – how is it considered in the noise assessment scenarios? So the operational scenarios considered the CHPP and rail loop when it is fully operational. Haul trucks on the mine access road associated with transport of ROM coal from Tarrawonga and Rocglen are explicitly included in the modelling. Noise from project construction including the CHPP, rail loop, rail spur has also been modelled.

So timing of overburden placement and worst case noise emissions – waste rock and placement would occur 24 hours a day. As above, the noise modelling has considered mining equipment operating in exposed and elevated areas. In practice, the proactive and real-time monitoring and management would be used to inform working locations, if required. So this is the last one – details of any further mitigation measures considered, modelled or not included in the results – noise modelling has considered various reasonable and feasible mitigation, as described previously in this presentation.

The modelling does not include the proactive noise management system which provides an additional layer of management and mitigation to achieve compliance with noise limits. Proactive management is successfully used throughout the mining industry, probably in Australia or in New South Wales, to manage noise levels within compliance limits, and that is the end of the presentation.

PROF WILLGOOSE: When you say "proactive noise management", can you be a bit more explicit about – I'm not a noise expert. What does "proactive noise management" actually mean?

MR WASSERMAN: Sorry, I thought you were going to say something there, Brian. You're welcome to take it or - - -

MR COLE: Well, what happens in practice is that you're monitoring the atmospheric conditions that are coming at you – wind, inversions – and you're also monitoring the noise levels at the monitors around the place and if you look like you're going to go over, you – you know, you might shut down a particular operation ..... or redirect that work somewhere else. So the idea is to, you know, stay under the limit that has been imposed and that happens.

PROF WILLGOOSE: Okay.

MR WASSERMAN: But it's a network of noise monitors that gets looked at all the time and levels are set below the criteria which are warning levels and then, you know, if they get exceeded, then people will investigate the noise in a particular area and then decisions will be made to continue working or to move equipment from one place to another place.

PROF WILLGOOSE: Okay.

PROF FELL: Can I just ask about that. I mean, obviously Whitehaven is an experienced operator. How many times have been prosecuted by the EPA for noise exceedances in the last five years, so it's a measure of how carefully you actually handle this controlled equipment.

MR COLE: Can I take that on notice, Chris. It has been very infrequent. I can't remember one example. And the - - -

PROF FELL: Please take it on notice that it's a fair question.

MR .....: Yes. I know. It is.

MR COLE: Yes. The reason for that is it's part of the proactive management. The people on site will set a tolerance band to give them room to move, so they will target something below, you know, it may be dB below the threshold or the limit. They would aim to work within that.

PROF FELL: Thank you.

MR HANN: John, the DPE concluded that one of the key differences, if you like, between the noise levels for the approved mine and the proposed extension are related to the shielding effect of the overburden or the waste rot placement and I think we touched on this earlier. Is that a fair conclusion? Is that a key – is that also a key difference, apart from the mining equipment which you explained?

MR WASSERMAN: Yes. But - - -

MR HANN: Is that also – is that correct? Do you agree with it?

MR WASSERMAN: There is – that is part of it to some degree and we can explain that.

MR HANN: Will you be able to provide us some understanding of how critical that is.

MR WASSERMAN: Yes.

MR HANN: Okay.

MR WASSERMAN: We can do that.

MR COLE: It's quite normal to do that as part of this proactive management. If you've think you've – you've got an issue in a particular location in the mine that is generating, you know, noise levels that are a problem, well, you fund it.

MR HANN: Yes. Yes.

MR COLE: That's – it's quite normal.

MR HANN: No. No. I appreciate that. It's fine. Thanks. Garry.

MR VAN MAANEN: Chris, sorry. Can I just follow up just in relation to your question about compliance with noise limits. Did you nominate a time period which you wanted to look back on or is - - -

PROF FELL: Just a reasonable period, so - - -

MR VAN MAANEN: A couple of years or three years or - - -

PROF FELL: Maybe five years or something.

MR VAN MAANEN: Sure.

PROF WILLGOOSE: Or three years or something, but not just last year.

MR VAN MAANEN: No, no. I understand.

PROF FELL: Just to give a feeling.

MR VAN MAANEN: Some context. Sure.

PROF WILLGOOSE: My – the – my question is about the blasting. How – relativities, you know, how important is the blasting in terms of noise exceedance – or in terms of the noise? I'm just thinking – you know, noise from equipment relatively well controlled. You can test the equipment, that sort of thing. But blasting presumably is going to be a function of the material you're blasting and so is going to be a big variable between blast and blast, I would imagine, depending on what material you're blasting. So the question then is what are the assumptions you've made in terms of the original emissions from the blasting?

MR WASSERMAN: I mean, I guess, you know, so there are good blasting contractors who do a good job and that needs to be taken into consideration. So we would expect a good contractor to operate. So for an assessment, like in the EIS, we basically used standard conditions and do our calculations on those standard conditions – empirical, sort of, equations. Now, that's the best we can do at the moment. What generally happens when a mine starts operation, there are many trial

blasts done and then equations will be developed for a specific mine or mine sites and they will then be used to do the predictions and work out the blasting sizes.

PROF WILLGOOSE: So what you're saying is that, in fact, there is an element of, there's the real issue required which has got a set of standard equations. Is that – and then once you – once the mine is operational, you then figure out how close your actual operation is going to be what the, essentially, regulatory assumptions are in the EIS.

MR WASSERMAN: Well, there are very specific criteria for blasting.

PROF WILLGOOSE: Yes.

MR WASSERMAN: Overpressure and vibration. So they need to be achieved.

PROF WILLGOOSE: Yes.

MR WASSERMAN: So the way we do the predictions is through pretty much empirical equations that have been developed over years of monitoring in the Hunter Valley. However, once the mine actually becomes operational, that gets done through trial blasting where they develop their own equations to meet the same criteria.

PROF WILLGOOSE: Okay.

MR WASSERMAN: It just provides you more certainty.

MR HUNT: To calibrate it.

PROF WILLGOOSE: So – so - - -

MR WASSERMAN: Its calibrations are better.

PROF WILLGOOSE: - - - how – I mean, take a scenario where, for whatever reason, you find when the mine is operational, that the blast levels under the assumptions would be – overpressures, for instance, would be higher than allowed. What can you – I'm not a blasting person. I'm just asking how would you then manage the blasting to maintain compliance?

MR COLE: Well, you would have to reduce the amount of explosive you're using.

PROF WILLGOOSE: Okay. So you can control it. That's the question I'm asking, so - - -

MR COLE: Well, you will have a pattern for a particular blast and you will be looking to move so many hundred thousands of cubes of material. Well, you adjust it to, you know, reduce the amount. You - - -

PROF WILLGOOSE: Okay.

MR COLE: You know, there's a pretty well-understood - - -

PROF WILLGOOSE: Okay.

MR COLE: - - - you know, process for designing your blast.

PROF WILLGOOSE: Okay.

MR COLE: Yes.

MR WASSERMAN: It's not just letting off one particular – one blast. I mean, there's a pattern of blasts like Brian was saying.

PROF WILLGOOSE: Okay. Yes.

MR WASSERMAN: So you can use different timing. It's – use smaller sizes. So there's a multitude of different ways that you can do it and that's what - - -

MR COLE: Different blasting materials, you know.

PROF WILLGOOSE: Okay.

MR WASSERMAN: Indeed. So - - -

MR HANN: All right.

PROF WILLGOOSE: Yes.

MR HANN: Anything else for John?

PROF FELL: No.

MR COLE: Thank you. Okay. Okay. Well, we will now move to the economic assessment. Stephen.

MR VAN MAANEN: This is the last - - -

MR HANN: Okay.

MR VAN MAANEN: - - - matter today. Probably getting hungry.

DR BEARE: But not least to - - -

MR VAN MAANEN: Saved the best.

DR BEARE: Yes. But I can go the shortest – both in stature and in length. But anyway - - -

MR HANN: We need any – we need a – here we go.

DR BEARE: Yes. This is just - - -

MR HANN: Thanks.

DR BEARE: Okay. So I'm Stephen Beare. I'm the director of ANALYTECON. It's a small consulting firm. I'm pushing almost 40 years now of being a statistician and economist. A good part of that was spent as the chief economist at the Australian Bureau of Agricultural and Resource Economics. Actually, that was, sort of, my – I vetted an awful lot of economic models and analyses, all directed at public policy and so I have – especially in the agricultural area and resources areas. The other person on our team was Sabine ..... There was another company, but we work in partnership. She did most of the translation of the actual mine information into the cost benefit as well as making sure we adhered to the guidelines for the assessments.

Whitehaven had a period of review done by Dr Brian Fisher, the managing director, and his big ticket item as he was an expert for the UN IPCC panel and then some additional reviews were done. One, I think, at the request of the Department – of the IPC – with Marsden Jacobs and I think another one was done by the Department of, what is it, Resources. So, I mean, the basic objective and conclusions here was the objective would estimate the net benefits of the project to the New South Wales and regional economies. And I guess, the best conclusion was summarised in the period of review there, but the project would make a substantial contribution to the economy of New South Wales should it be approved.

The general approach that we take is to identify the benefits and cost that accrued directly or indirectly to the State of New South Wales and the local region under the project under two requested scenarios. The scenarios were requested by Whitehaven. One was no mining operations. The second one was to operate the approved mine. The results we're going to present today are just to stop the numbers from being too prolific. We're looking at the no mining assumption, that the full date is in the report, but roughly about 60 per cent less, I think ..... operate the approved mine.

PROF WILLGOOSE: When you say operate the approved mine, you're talking about the 2018 proposal?

DR BEARE: I'm talking about the one that's been approved.

MR .....: The approved.

DR BEARE: The approved.

MR HANN: You know, 2013.

PROF WILLGOOSE: Okay.

DR BEARE: Approved.

MR HANN: The one that's currently approved.

PROF WILLGOOSE: Okay. Right. Okay. Right.

DR BEARE: Yes. Yes, yes. And the other – so I mean – basically, I think it's to use a frame that is consistent with the guidelines for assessment of mining and coal seam gas. Those are set out by the government. And to use a very standard accounting system, one which everyone can recognise, understand the definitions of, which is the national accounts or the gross state accounts so New South Wales GSP. The same accounting procedures are used for that as we have used for the mine. I think that makes it simple and, again, more transparent, to use a – you know, it's not a perfect accounting system but it's a well-recognised and established one and it's – and it is easy to – you know, it is easy to follow what the sequence is. And that benefits themselves.

They say that an economist is joking when they use decimal points but, you know, the orders of magnitude are sort of millions, right. You can't ..... but just about $1.2 billion under no mining operations. I think the key things there the fact that most of – the dominant source of revenue is the actual royalties that were accruing to the state and our estimate was less than the Department of Sources, which is sort of ..... take a fairly conservative approach, mainly on the differences of assumptions about coal prices into the future. There was also 271 million in direct employment benefits, calculated as disposable income. Why disposable income?

Because part of – your other income goes to taxes and that has to be picked up later as repatriated taxes coming back from the Commonwealth to the state, profit to New South Wales shareholders. Those are relatively smaller items and probably are a little bit more nebulous in terms of how you actually calculate them exactly. But the flow on benefits are those that occur to the general increase of economic activity associated with a mine. That starts by supplying, you know, goods and services for construction and mining operations but also could increase demand for services within a local economy – you know, that's – those tend to cascade on top of each other.

You can get a first round effect which is sort of, you know, the direct effects of additional sort of supplies going into the mine and then you can start adding on effects of, you know, people have extra money and the effects ..... we use the smallest possible multiplier of effects when we use this to get to be conservative but, again, you're getting a number of about 316 full time equivalent jobs. It's not constant over time, obviously. That's an average over the life of the mine – and 146 million. And in terms of value add, how much does this contribute, the extra is about 322 million. And the value add is GSP, it's the net contribution to the economy of all the additional activities that take place.

PROF FELL: Is that net present value?

DR BEARE: Yes.

PROF FELL: Right. Thank you.

DR BEARE: Yes. All in NPV terms. Yes. Over the life of the mine. The only one that isn't is the FTE, which is – you know, because a mining employee is different.

PROF FELL: Sure. Of course. Of course.

MR HANN: Yes.

DR BEARE: Yes. Different amounts of people over time. Sorry, I should have made that clear. The net benefits to the local economy, we do not – there's a connection between taking information that's at the ABS level about an economy and moving it down to the local level, right, and there isn't a lot of information at the local level about who owns what business and do they live in the region or how much of this person's business is actually importing, you know, goods from other states or other places. So the only thing we really have a good handle on is employment. So we stay away from the value add and we just focus in on what we think we can come up with a reasonable estimate.

And so again, those are just full employment – employment numbers and local – local end pieces and disposable income in PB terms. You know, and for the economies those are substantial numbers. I mean, you know, getting down to very local areas. The requested peer review basically was quite – well, it was comfortable for me. They – you know, they basically felt it was within the guidelines. I don't know so much about within their expectations but the benefits and costs were correctly identified. There were a few things that they did want to raise about, you know, some additional types of modelling that might be done or a different way of doing it and we'll respond to that as required.

But I think – from my point of view, I think the most important thing is not to be making assumptions because – I mean, a lot of assumptions go into economic analysis. I mean, a lot of things aren't nearly as calibrated as – you know, we were talking about these other things. It's just not possible. So let's not make assumptions that are prone to overstating or – the benefits or even the costs of a project. So for example, when we look at the employment effects, we're only assuming 20 per cent of those jobs are new jobs We're assuming 80 per cent of those are coming from people erstwhile employed. Now, this is more to be consistent with the New South Wales guidelines and – but - - -

PROF FELL: Yes.

DR BEARE: - - - that's a very conservative assumption and we'll go back to it. That we use only the first round multipliers. We don't do these cascading multipliers

because multiply – to essentially translate a dollar expenditure into additional benefits from the rest of the economy, we use the lowest level. Within the report, there is a complete description of the limitations of input, output analysis that these multipliers are about. There's even a recipe at the back for doing it yourself because I think it's important to be transparent. These – that it can be replicated. It will be the same no matter whether you do it in this community or that community. We have used the exact same thing.

This project, that project, they're all going to be the same, they're all going to follow that. And we only attribute unambiguous benefits to the local economy. If – there are obviously, you know, going to be business profits that accrue locally. That's going to happen but we don't know what they are so we can say that they're there but we just – we're not going to add those numbers in. And I think this was generally supported by the GIG submissions, which basically looked at – and, you know – and it gave a much more optimistic sort of a view of the actual returns to the projects, mostly from differences in coal assumption prices but nevertheless, I think it is, you know, prone – it doesn't want to be grossly understated but it doesn't want – it just certainly doesn't want to be overstated.

I guess my take home message, which I think is probably the most important, is that a lot of people sort of think of this as sort of competition. The labour competition is taking jobs out of agriculture and putting them into mining. But in rural Australia, agriculture is a primary source of employment and it's been dropping steadily for the last 100 years and there is – if you ask the question what – there's been a steady decline in the rural population to go along with that. That's just what's – that's part of what's it about. 19 per cent drop in employment in agriculture over the last 12 years and that's – it's steady, little ups and downs but the trend is – when we were at the bureau, we used to always ask what year was it going to go negative, you know. Just trending ..... along.

But – and that's – you know, that's the backbone of what's happening. Agriculture is becoming capital and intense. The new precision agriculture is going to make that even more so. I mean, the US has given up on preserving the family farm because it's corporate, there's no pushing it away. So that's the underlying trend in agriculture and it's not – rural Australia is not immune from any other trends that are generally going on in the economy that you read about; right. I mean, you have downward trends in manufacturing, you have downward trends in retail trade due to the internet. All these things are happening everywhere, right. And those are also putting pressure on it.

The growth area is in services. That's been the dominant sector of pushing jobs in Australia and most of the developed world. Does rural Australia have a real claim to delivering services when they can be delivered almost anywhere, you know. So it's a tough ask. So what you would be seeing is basically a pretty strong downward pressure on rural populations. And we can see that the local population growth in the – you know, the local regions there, the – quite a distinct difference between what's

happened in Narrabri, which has sort of been a strong drop and a bit of a levelling out, and actually a recovery in Gunnedah.

And I would – I can't prove it, but I would hold, it has a lot to do with employment in mining. And you can see the – the difference in employment in Narrabri and Gunnedah, in terms of the actual capture of the employment with people who are residing in that area and working in – in – in mining. Gunnedah has been much more – has picked up a heck of a lot more of that – of it over time, and that's been reflected in pretty strong – you know, recovery in their population growth, recovery of, you know, a whole range of things – a wider range of services. So I think, you know, we can't look at rural Australia in isolation, just – this is just agriculture. This is just one thing or another. You have to think about, you know, what is the future for that.

PROF FELL: I found it interesting that people in Boggabri were fully aware of the argument you're just putting, but said, it's not happening to us, and we're closest to the mine.

DR BEARE: Well, it – yes, there's two things. Right. It's – proximity is a good thing, but people are free to choose where they want to live and – and there's a bit of – there's a bit of critical mass of getting services and things together that makes potentially another place more, you know, amenable. They're still going to benefit but, you know – and I don't know if you've been to the Liverpool Plains but, you know, there – I mean, there – there's a nice contrast. That's – it's not going anywhere. You know - - -

PROF FELL: ..... offer a comment.

DR BEARE: Yes.

MR COLE: Well, it's – it's obviously tied to the range of services. You know, the towns are competing and – and Boggabri is not able to provide the – the range of services. I mean, people say that to me - - -

PROF FELL: Yes.

MR COLE: I mean, it has its attractions and, you know, there are some – there are people that choose to live there.

PROF FELL: Yes.

MR COLE: But there's more that choose to – to live in Gunnedah. There's always - - -

PROF FELL: Well, probably the point that's coming through from your presentation is that mining is giving jobs.

DR BEARE: Mining is – yes, I think it's – it's – it's - - -

MR COLE: Sustaining these - - -

DR BEARE: It's – yes, but what I'm saying, it's not stealing jobs from agriculture. It's replacing the jobs lost in agriculture, and I think that's – that's probably more - - -

MR HANN: There's a natural decline, if you could put it that way - - -

DR BEARE: Yes.

MR HANN: Is that what you're presuming - - -

DR BEARE: I'm saying – yes - - -

MR HANN: - - - from a loss of agricultural employment - - -

DR BEARE: Yes.

MR HANN: - - - rather than mining stealing the - - -

DR BEARE: Yes.

MR HANN: - - - the jobs. Is that – that's - - -

DR BEARE: Yes. That's – that's a nice summary. Yes. That's it from me.

MR COLE: Just to complement what Stephen is saying about the model, he's not able to have the - - -

PROF WILLGOOSE: Don't go - - -

MR COLE: - - - the granularity to cover the local impacts, if you think back to the – the hearing, specifically what Don Ewing and Gae Swain said about Gunnedah, what Barry Thomson said about the Boggabri businesses, what Russell Stewart said about Narrabri. I mean, they're the real stories at – at the – the town level, about – about that – the – the impact. And I've spoken to the business owners in Boggabri. I mean, that – that's what they're saying to me, we depend on the mining people in the area that, you know, come and buy their lunch or their coffee or whatever.

MR HANN: Yes.

MR COLE: And the, you know, the hardware store, the IGA. I mean, without mining, Boggabri would go further back.

DR BEARE: And it – it's an interesting story, too. I mean, there's – it's a – it's a different game, but, you know, you think about it, school. And, like, people will get upset, you know, if their local school is closed because all – but, yet, if you have a – sort of a vibrant centre, with enough people, then all of a sudden, you have teachers who want to teach. You have – you have – you know, so you – there's a delicate set of trade-offs, of what's in location now and what really is likely to evolve over time with the way agriculture will undoubtedly evolve, in terms of, you know, I mean, it's – you know, we're talking about the equipment. I mean, there's equipment that's used on farms now that is just – you know, it just isn't – isn't touchable, you know, for – you – you know, even my experiences – it's just beyond what I can – may as well forget it, and go - - -

MR COLE: Yes.

PROF WILLGOOSE: Or the GPS controls.

DR BEARE: GPS control. They go at night, you know, to – to do their spraying in the dark and – yes.

PROF WILLGOOSE: So if there's not a question more – more just – maybe you can explain it to me, because I – because if you look at the – the employment numbers there, you know, you're looking actually in mining since about 2004, about – about 1000 people, thereabouts, and you look at maybe the local population – so in that 1000, there's probably, okay, you might say that it's maybe leads to a population – population associated directly with that maybe a couple of thousand - - -

DR BEARE: Yes.

PROF WILLGOOSE: - - - something of that order, and then you look at the local population growth down there, which, you know, from a base of about 2005, seems to go up by about 1000. I'm – I'm just – just a – a thought that you're actually comparing two – one – two different things, really, the – one, the employment and one, the population growth. And whether there's a possibility that there has been some – I'm not an economist - - -

DR BEARE: Yes. No, that's all right. Don't - - -

PROF WILLGOOSE: - - - so, you know, I'm – I'm - - -

DR BEARE: Don't worry about it. It keeps you safe.

PROF WILLGOOSE: That's why I – I feel like I can ask a stupid question about this.

DR BEARE: Yes, yes.

PROF WILLGOOSE: Is – is it possible to – to – I mean, because I know in the mining towns, I – I grew up in a mining town, in Muswellbrook – and I know what the concerns were when they went through a mining boom in 80s, it – you know, and it was genuinely the competition between mining jobs and agricultural jobs, and the fact that the people who were involved in agricultural industry and the non-mining industry, essentially were effectively out-competed economically. You know, to get their car serviced at the local garage now cost 50 per cent more than it used to and things like that. Whether there's any possibility of – of doing a little more of this to allay fears in Narrabri and Gunnedah that a similar sort of thing may not be – because if you just take the mining – people that are involved in the mining industry, I have, you know, I can see where you're coming from but there really are – in most of these towns, there's two parts of a – parts of a community. There's the people associated with the mining industry, who are getting good salaries, and people associated with the agricultural industry, which – who are, by and large, not getting those salaries.

DR BEARE: Okay.

PROF WILLGOOSE: And – and the services that used to be servicing the agricultural industry or priced for their salaries, are now being priced for the mining industry salaries.

DR BEARE: I mean, there's a boom/bust – and probably Western Australia is probably the best example of that phenomenon, you know, where you see parts of town that grew and then it stopped and they were – you know, I mean, that's – that – that is an issue in mining. I mean, it was an issue for the industry as a – as a conglomerate, because I do quite a bit with – you know, at – at a different level, so, you know, they were – the mining industry was competing for its – with itself for employment, as much as anything. It was competing with the rest of the world for equipment.

It was a – you know, it was – it was – it was full on. I – you know, so you ask the question about, is – when is it, you know, is that likely to happen in the next 15 or 20 years? You know, is there another China? I don't think so. You know, there's some – I don't think there's going to be anything like what we've seen ever again. I just don't – I don't see that happening again. India is very difficult to imagine it becoming organised enough to do so, even though it has the population and – and South America had had a lot of promise for many years but doesn't seem to ever – seem to organise itself into anything. But, you know, China was a – a massive, you know, government commitment to a huge amount of infrastructure and it was across the board, you know, and I guess what's nice about, you know, being – it was – you know, it was a great opportunity, in a way, but it was also – yes, it – it was disruptive.

PROF WILLGOOSE: Okay. But I – but I guess to – to get to the point - - -

DR BEARE: Okay. Yes.

PROF WILLGOOSE: - - - is that – is that – is that I – I guess your economic analysis doesn't reflect one of the concerns that the community has - - -

DR BEARE: Okay.

PROF WILLGOOSE: - - - which is that the competition, you might say, for mining priced local services versus agriculture priced local services. You know, the – the local sandwich shop that can now charge – I don't know, $5 a sandwich, as opposed to $3 a sandwich, when the town was basically agricultural. That – that's an example of what I'm trying to get at.

DR BEARE: I will tell you - - -

MR COLE: When it was agricultural, the sandwich shop wasn't open.

MR HANN: No, but - - -

DR BEARE: But to compare Gunnedah and Muswellbrook, I mean, they're totally different.

MR VAN MAANEN: And I think what Stephen was saying earlier is that with all of these things, they necessarily entail a complex system of trade-offs, right. And – well, sorry, Stephen. You were going to elaborate more.

DR BEARE: No, no, I was just – you know, I don't – the ABS does do cost, you know, of living. It just doesn't get down as fine as - - -

PROF WILLGOOSE: Okay. So what you're saying is that the data is not there to be able to do that sort of analysis.

DR BEARE: We – yes. But in a general sort of way you might – I will think about it, without committing. Is that all right?

PROF WILLGOOSE: Yes. No, I'm not asking you to do it. I'm - - -

MR HANN: And it ties in to the social impact assessment.

PROF WILLGOOSE: Yes. And the - - -

DR BEARE: Yes.

PROF WILLGOOSE: And some people in the community have expressed concerns around that style of - - -

MR HANN: Indeed they have. We need to wrap up the meeting and so I will just ask Gary and Chris, have you got any further questions that you ..... while everyone is here?

PROF WILLGOOSE: No, I've asked all my questions as we've gone through.

MR HANN: All right. Well, let's – we will call this to a close, but first I would like to thank you all.

MR COLE: Can I say – I would like to say some things just to finish up.

MR HANN: Sure. Yes. Indeed.

MR COLE: Look, it seems to me, rightly so, you've concentrated on water – you know, groundwater and surface water. It's obviously very topical at the moment. I think it's important to remember the mine – the improved mine had the groundwater and surface water approved. The difference is really the Vickery South deposit which really doesn't – should not impact on anything and, you know, Gary has talked about the bore field which, you know, Noel has – you know ..... is very familiar with. A lot of the work we did in the early days on this project in relation to water was predicated on the fact that we Blue Vale void and we had an overburden dump that was in a different location. We had made a pragmatic decision last year to basically pull back from the Blue Vale void. We weren't getting any issues about it, but there were public concerns. Likewise with the overburden dump – it's exactly the same - - -

MR HANN: This is the one in the east – southeast, I should say?

MR COLE: Yes, the western boundary of the western overburden dump is exactly the same.

MR HANN: Okay. Yes. Okay.

MR COLE: So you would say, well, what a – when it comes down to it, in around the mine itself, you know, what are the differences and, you know, we don't – there's nothing really showing up that's any significant difference. In terms of the groundwater effects, etcetera, they are very, very minor for the reasons that Noel has articulated. So I mention that. I mean, the project, as you've heard, in terms of the amenity impact – people are raising those; that's valid. We've used the best modelling available that – I mean, you can tell from the people that have been here – you know, they've worked for the regulators.

They're the most skilled people we can get and the peer reviews we have had done have all pretty much – have validated the modelling as well. And interestingly enough, the peer reviews done by the DPE – they've basically also verified that the basic models have been done. Sure, they have picked up on a few issues. They have to; that's part of doing a peer review. But no one has come up with any substantive issue that undermines the veracity of the work that has been done. So thank you for your time. As we said, we will be preparing written responses to your questions. David has said we should have a transcript of this within a few days and we will work on that accordingly.

MR HANN: Thank you. Thank you all for attending. I know it has been a fairly lengthy session, but it has been of great value to us, so it's much appreciated.

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