Transcript of Proceedings

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THE HONOURABLE JUSTICE C HOLMES, Commissioner

MR JAMES O'SULLIVAN AC, Deputy Commissioner
MR PHILLIP CUMMINS, Deputy Commissioner

MR P CALLAGHAN SC, Counsel Assisting
MS E WILSON, Counsel Assisting

IN THE MATTER OF THE COMMISSIONS OF INQUIRY ACT 1950

COMMISSIONS OF INQUIRY ORDER (No. 1) 2011

QUEENSLAND FLOODS COMMISSION OF INQUIRY

BRISBANE

..DATE 19/05/2011

..DAY 25

THE COURT RESUMED AT 10.00 A.M.

COMMISSIONER: Yes, Mr Callaghan?

MR CALLAGHAN: I call Rory Nathan.

RODERICK JOHN NATHAN, ON AFFIRMATION, EXAMINED:

MR CALLAGHAN: Could you tell the Commission your name and occupation, please?-- My full name is Roderick John Nathan, colloquially known as Rory. I am a hydrologist with Sinclair Knight Merz.

Dr Nathan, you were engaged by Seqwater to perform a review of the hydrological findings in the Seqwater report of the January 2011 flood event, is that correct?-- Correct.

I might just ask you a couple of questions about your report itself in the first place. You have a copy of it there?-- Of?

Of your report?-- Yes.

On page 9, you discuss the concept of simulation framework. Can you tell me this: do you yourself develop models of the kind under consideration at page 9 of your report?-- Yes, I do.

And if you were to commence such a project today, would it adopt the deterministic or the stochastic approach as discussed on that page?-- I would use the stochastic approach.

When would you last have commenced a project using the deterministic model?-- My personal practice, we have been using stochastic approaches for over 10 years.

Thank you. Can we just go back to page 3 of your report, and just touching on one subject which we haven't perhaps heard so much about yet, right at the bottom of the page, you mention the possibility of "gaps in the rainfall networks being mitigated by incorporating information from weather radar". Do you have a sense of the state of the science which model radar to be used for that sort of thing, in just general terms?-- Yes. This is not a field that I have deep technical knowledge of. I am certainly aware of the increase in efficacy of radar images and its use in rainfall forecasting. I am also aware of in some sense it has been a very attractive proposition for a long period of time, so clearly there were some practical issues associated with using it for quantitative purposes.

All right. And finally, can I ask you to just take a look at Exhibit 408 - I will put a copy of it in front of you, you may have already seen it - but it is a list of topics which, from one source or another, there has been a suggestion that the manual for operating Wivenhoe might address. Have you had the opportunity to look at that yet?-- Yes, I have.

I am not asking you for your responses at the moment, but have you been able to look at it to the extent of seeing for yourself whether there is an additional topic or topics which you think ought to be included on that list?-- It is a very comprehensive wish list of topics that could be explored. There is nothing additional. My preliminary feel is that there'd be benefit in getting opinion and start ranking them in terms of return on effort, is my sense on that.

All right. Thank you very much. That's all I have.

COMMISSIONER: Thank you. Mr O'Donnell, did you want to go last?

MR O'DONNELL: Yes, he is my witness, thank you.

COMMISSIONER: Mr Ambrose?

MR AMBROSE: No questions.

COMMISSIONER: Mr Rangiah?

MR RANGIAH: Mr Nathan, I represent some Fernvale residents. The suite of software that comprises the Real Time Flood Model does not include the hydrodynamic model, does it?-- No.

Would hydrodynamic software be of assistance in managing a flood event?-- I do feel you would need to approach that cautiously. I think a hydrodynamic model would be a really valuable tool for helping to calibrate the rainfall run-off model, the flood model. So it is an invaluable tool for that purpose. What I would prefer to see is if you have demonstrated that the rainfall run-off model is capturing the characteristics of the floodplain adequately, I think there would be a case for not using it during a flood crisis, and my reasoning for that is during the flood crisis you want to minimise the opportunity of anything going wrong, you want to be able to focus your energies on where the biggest uncertainties are and the biggest returns on effort are. My concern about incorporating hydrodynamic model in a flood crisis is that it is potentially distraction and it is potentially looking at an area of the problem where there is least uncertainty.

So-----?-- So I think it should be explored but I don't think it is - I don't think it is necessarily something you would want to put in.

But certainly you seem to accept that hydrodynamic model would be particularly useful outside a flood event in terms of calibration of flows?-- Outside of a flood event, yes, I do. And the main point - it is not that a hydrodynamic model is, if you like, the Rolls Royce of rainfall run-off models; they are doing quite different things. So the hydrodynamic model gives you a good understanding of the relationship between flows and flood level as you move downstream through the river.

Now, stochastic models, are they available commercially?-- There is - we have released a stochastic model, in fact, for free. It is a free download. And that is starting to get some take-up in the industry, but only recently.

You said that you had been using stochastic models for some years? Is that correct?-- That's correct. We've developed our own stochastic simulation framework which we have been using for, as I said, over ten years and it is only very recently that we've provided that to - like, within the last year or so, to two other agencies, the New South Wales Department of Water and the West Australia Water Corporation are both using it for their dam studies, and there has been a stripped-down version of it available for public use for the last year or two.

When you say "we", do you mean SKM?-- I mean, Sinclair Knight Merz, correct.

Now, when were you asked to provide this report?-- In - must have been mid-February, late February. I think the date of the report was March, 11th of March.

And prior to the January floods, was there ever any - was there ever any approach to you or to SKM to conduct any assessment of the adequacy of the Real Time Flood Model?-- Not prior to January.

I think you accept in your report that it is not comprehensive in the sense that there are a number of parameters or issues that you didn't examine?-- Correct. In the Seqwater report?

Yes?-- Yes.

And - thank you, I have nothing further.

COMMISSIONER: Mr Murdoch? Sorry, Mr Porter.

MR PORTER: That's all right. No questions.

COMMISSIONER: Thank you. Mr Murdoch?

MR MURDOCH: No questions.

COMMISSIONER: Ms Brien?

MS BRIEN: No questions, thank you.

COMMISSIONER: Thanks, Ms Brien.

MR MacSPORRAN: Nothing, thank you.

COMMISSIONER: Mr MacSporran.

MS McLEOD: No questions, thank you.

COMMISSIONER: Right, Mr O'Donnell. Okay, thanks.

MR CUMMINS: Sorry, Commissioner.

Dr Nathan, would you have expected that the flood - the flood manual would have been based on a knowledge of the risks of adopting the various levels that are adopted within the flood manual?-- The - I didn't look at the flood manual. That was not part of my review, so I only have a very cursory knowledge of that. So the trigger levels that define the different strategies between W1 and W4, you could assign probabilities to those risk levels - to those trigger levels. I am not aware if they have or haven't done that.

Would it surprise you if they hadn't done it?-- Yes, I think I probably would be surprised if you didn't have a handle of what the risk of those trigger levels would be.

And would you expect a revision of the flood manual to have a risk based framework behind it?-- Yes, I would.

Okay?-- Most definitely so. And I think that's covered by one of the questions in this list, I think would address that.

And coming back to the question on hydrodynamic models, given the enormous value of the assets lying below Wivenhoe, and the complexities with the interaction of the intermediate catchments and tides, would it seem unreasonable, given that there is a fair amount of resources available to the Flood Control Centre, to actually run a hydrodynamic model perhaps as a background check within the flood model so that it doesn't distract from the principal flood operations engineer but acts as support for the whole process?-- Yeah, I think there would be more value in thinking of it as a backup support or confirmatory analysis. I think the main - the dominant point of interest is how does that flood wave move downstream, and it is apparent from all major events that have occurred in this catchment, apart from, say, the '74 event, that the flood decreases in its peak as it moves downstream. And the main reason for that is the availability of floodplain storage, and that can be just as well easily captured by rainfall run-off model as it can be a hydrodynamic model. So I do feel we should be able to capture the majority of that impact through a rainfall run-off model, but the idea of having a more sophisticated model in the background, as long

as that's not part, if you like, of the critical path in terms of informing decision-making, I think is a good approach.

And would a hydrodynamic model enable you to provide better advice in terms of evacuations, and the like, along the river than a more - than a simpler one-dimensional model?-- Yes, it would, but not on its own. The sorts of models that have been talked about will only give you the flood elevation along the mainstream of the river. To then address the issue of what does that mean in terms of inundation, you have actually got to have done a whole lot of analysis around the relationship between the level in the river at that point in time and potential properties affected. And for that you need another - if you like, a two-dimensional analysis and a process to map that. So there is an additional step you need to provide that information.

And prior to implementing such a system - and I am not asking you to comment on the accuracy of available topographic information, and answer the question more in general - would you generally accept that it would be normal to fly a laser-based aerial survey prior to commencing that operation?-- Certainly.

Thank you, Dr Nathan.

COMMISSIONER: Mr O'Donnell?

MR O'DONNELL: Just on that last topic Mr Cummins was raising, there are areas of responsibility for the people who manage the dam and the people who assess the extent of any inundation within, say, Brisbane?

COMMISSIONER: I am sorry, Mr O'Donnell, I didn't hear the last part of that.

MR O'DONNELL: There are areas of responsibility between those who manage the dam and those who assess the extent of any inundation within Brisbane or a need for evacuation or warning. Is there a question as to which - who should have what function, in short, where the function of the flood engineer stops and where the function of, say, the Brisbane City Council might start?-- I would be probably unwilling to try and draw a boundary between that. I think you're highlighting the need for a strong level of communication between those two agencies.

Well, what I was going to was do the people operating the dam, trying to operate the dam to its maximum flood mitigation ability, need to know more about the extent of inundation within Brisbane, or is there the extent of the key knowledge for them of what's happening downstream, the flows in the Lockyer, Bremer and, say, at Moggill?-- Yes, I understand your question better. Yes, I think the operators - the relationship - you can develop with prior knowledge a relationship between flow downstream of the dam and potential

inundation, and the operators of the dam, probably their prime focus should be on what the flow trigger - what those flow levels are downstream of the dam. They can be determined prior to an operation, so they shouldn't need to know what the actual inundation impacts are going to be to operate the dam appropriately.

Right, thank you. Now, your report doesn't have a CV attached to it. Could I hand you one, please, and see if you can confirm it is correct? Is that accurate?-- That's my CV, correct.

At the foot of the first page under the heading "Fields of special competence", you have a summary of your areas of specialty. To a layman would you describe it as water engineering?-- No, I would probably regard myself as an engineering hydrologist.

Can you tell us what's been your experience with the operation of flood mitigation dams; that is, dams which have a flood mitigation component?-- I have worked on numerous dams for flood mitigation. I guess one of my special fields of interest has been evaluating flood risk for dams. I have done this - I have worked on flood dams - those aspects on dams in every State and Territory across Australia. I have lost count of how many dams I have worked on. And I have also been contracted to provide advice on the subject to the US Corp of Engineers and the US Bureau of Reclamation who are, say, the leading agencies of dam ownership in the United States. So I feel I have got both an international and a national recognition for my work in this area.

Right, thank you. I will tender the CV.

COMMISSIONER: That will be Exhibit 420.

ADMITTED AND MARKED "EXHIBIT 420"

MR O'DONNELL: If you have your report there, page 18, that's a map showing Wivenhoe pretty much in the centre and it indicates the estimated 48 hour rainfall assessed on its AEP intensity. Could I ask you - and you discuss that at some length in your report. Can I stand back from that, though, and ask you a slightly broader question? Can you tell us, please, from your professional opinion, what was the extent of the rainfall over the catchment of Wivenhoe during this flood event, and what in your opinion was the ability of the dam to deal with that extent of rainfall?-- Yes, that - look, as a hydrologist I tend to take a catchment wide view, and when I look - when I look at this event, it is very clear that we've got an extremely large rainfall event. Mother Nature's dumped an inordinate amount of rain in this entire catchment. It is in the order of over eight Sydharbs worth of rainfall volume has landed on the catchment.

Sorry eight?-- Eight Sydharbs. So people would think of Sydharb as the volume of Sydney Harbour, so if we think over eight Sydney Harbours was dumped on this catchment during that three-day period. So it is a significant amount of water. If you compare that volume to the available flood storage in the dam, which is probably only around three Sydharbs, you instantly get a feel for what is the ability of that dam to control the flood. And I understand there has been a lot of analysis around gate operation procedures. Taking a catchment wide view, I think they are probably of second order - second order importance, that really we have a situation where we have got five Sydharbs worth of rainfall that can't be captured by the dam. If you look at this figure here on figure 5.1, it shows that, first of all, over - almost half the catchment upstream of Brisbane lies below Wivenhoe Dam, and if you look at the average rainfalls below Wivenhoe Dam and above Wivenhoe Dam, it is probably - a bit less than half of that rainfall fell on the catchment below Wivenhoe Dam. It is particularly interesting, though, to see the yellow and tawny colour dots that sit below Wivenhoe Dam. That's indicating that at multiple sites immediately below Wivenhoe Dam, they were the areas that received the most extreme rainfall during the event. So the rarities of that - they are the rarest of rainfalls. They are unusual. It is a Noah's Flood kind of rainfall. The likelihood of them being exceeded in any one year is sort of 1 in 500 to 1 in 2000. So very rare rainfalls. They occurred downstream of the dam. I think when you look at from a catchment wide perspective, slightly less than half the rainfall fell downstream of Wivenhoe Dam but a very intense part of that storm fell downstream of Wivenhoe Dam.

You made a comment in that area - I can't recall the exact words but something like when you consider the volume of the rainfall in the catchment, the gate operating procedures we have been talking about at length were of secondary importance. Can you explain what you mean by that?-- From a perspective of the catchment outlet where you have got eight Sydharbs, or over eight Sydharbs of volume of rainfall, if the available storage in the dam is only three, there is five Sydharbs of water that has got to go somewhere. So I think if you put it in terms of, say, the '74 event, which is very front of mind for people, this event was probably twice the volume of the '74 event, yet the flood level at the Port Office gauge was a metre lower than the '74 event, even though the flood event was nominally twice the size. So clearly the dam is having an appreciable mitigation effect. The extent to which you have got more flood mitigation out of it, to me, when you look at the kind of gross catchment conditions we're talking about, you could possibly have got - we could possibly have got more flood mitigation out of it - I truly haven't looked at that and I don't know - but my feeling, when you look at those numbers, is we can only be talking about finessing something; that the majority of the floods, I think, are due to Mother Nature and we had little control of that.

COMMISSIONER: Can I just interrupt? What if the dam had been

at a level 300,000 megalitres lower at the start of the event?-- The 300,000 in percentage terms, I am trying to remember what that would be - that would be-----

I am talking about 75 per cent?-- -----about the 25 per cent, would it? Yeah.

Yeah, I think that's right?-- Studies have known that if you had the reservoir drawn down by 25 per cent beforehand and followed the operating manual as it stands now, you may have reduced the flood peak in Brisbane by the order of, I think, from memory, 10, 15 per cent.

But if you hadn't followed the manual and maintained it at 75 per cent?-- I am not sure - I don't - wouldn't have been possible to maintain it at 75 but-----

Well, if you adopted a set of rules which made that the point at which you attempted to return the same way that you now attempt to return to 64?-- So if you had started 25 per cent down and then operated not in compliance with the manual, you change the operating procedure, then I think the potential for mitigation at Brisbane would certainly be greater.

Greater than what, sorry?-- Would be greater than 10, 15 per cent.

Right, thank you?-- And I think that reflects the fact that what we're really doing there is increasing the volume in the dam that's available to capture the flood, obviously. So in those gross terms I am talking about it might go from three Sydharbs up to three and a half, four, whatever it is, compared to that volume of rainfall.

But you haven't been invited to look at that at all, I gather?-- I was involved - I did some review on behalf of Seqwater of the work they did a month or two ago in the analysis of that work.

MR O'DONNELL: Just to identify that work, that's in Mr Borrows' witness statement, I believe?-- I haven't - I am not sure where that's been submitted.

PB23. No, it is actually PB19. It starts at 145. I am looking at page 145 in the bottom right-hand corner?-- So Impact of reducing the full supply level of Wivenhoe?

Yes?-- Yes.

Is that the paper of which you were a peer reviewer?-- The actual form of this - I haven't seen the actual form of this paper before, from my knowledge, but the work that looks to be behind it is the material that I worked on. So I was able to - so the actual final form of this paper I haven't seen but certainly I was involved in looking at the approach they were using to provide information of this form.

There were a number of calculations starting at page 148. Are

they the calculations or the modelling which you peer reviewed?-- Yes.

If you-----?-- That looks familiar, so.

If we look over at 151, in the lower half of the page there is an email from Barton Maher of Seqwater to you?-- Oh, right, yes.

Recording some of your involvement?-- Correct.

Go back to 148. The option the Commissioner just raised with you I think is option 5?-- Yeah.

You will see that at 147. It is lowering the dam to 75 per cent of FSL and operating the manual as though you crossed out the 67 and inserted 64. So all your operating procedures operate from 64?-- Right. So if I am reading that correctly in this format it is a 40 per cent reduction. I also note that in my earlier answer I said 10 to 15 per cent, and this says 24, and that's not - doesn't accord with my memory, but if this is how that's written there, then I stand corrected.

Sorry, I am not following you. I am looking at page 148 under the heading option 5, right-hand column?-- Yes.

Isn't that the option we're looking at?-- Yes, which - and that's a 40 per cent reduction in flow.

That's in the peak hour flow from the dam, is it?-- Yes. That's with the combined revised operating procedure and the drawdown. If that's option 5.

Yes. The maximum outflow from the dam would be 4,512 CUMECS?-- Right.

And the maximum lake level would have reached 74.25?-- Correct.

So on that scenario is it likely that the W4 strategy would have been triggered?-- I - yeah, I - I wouldn't feel comfortable commenting on whether W4 would be triggered on that scenario.

Right?-- I don't know.

With the maximum outflow from releases from the dam of 4,500 CUMECS, when one considers the rainfall downstream of the dam and the flows from the Lockyer and Bremer, the rainfall itself flowing into the Brisbane River, can you comment on whether, whether there would have been inundation in suburban Brisbane?-- Well, the trigger level, as I understand it, for, sort of, escalating or extensive inundation consequences is at 4,000 so if we are already releasing 4,500, when you add to that the Lockyer, the Bremer and the other ungauged areas downstream of the dam there still would have been - had to have been inundation of Brisbane.

To work out the extent of the inundation, whether it would have been as severe as January was or the depth of inundation would you need to use a hydrodynamic model?-- Yes, I would want to use a two dimensional hydrodynamic model to actually map the extent to which that would inundate the areas away from the mainstream.

All right, which haven't been done yet, to your knowledge?-- No.

I suppose the other thing I should draw to the Commission's attention. If we go back to page 144. That's the covering letter sending these calculations to Mr Bradley. In the fourth paragraph second sentence it mentions, "This review is intended to provide an order of magnitude assessment." In other words, qualifying its absolute accuracy?-- Sorry, I was just slightly disconcerted when I - just referring back I saw there was - I commented earlier that I stood corrected on a point I made but it is actually a different option that I was referring to so the option that was in my mind does not appear in this table. So I am just not familiar with this exact presentation.

COMMISSIONER: What's the difference between what we are talking about and option five just to get that straight?-- The option I was talking about was the starting with the 25 per cent but maintaining the current operating rules.

Right?-- Whereas that option is not presented here.

Can I get it clear; what was your role in this paper? I thought it was peer review but then you said something about your figures being used. Anyway, what did you do in relation to this paper, just tell me that?-- They did the work and I reviewed it and tested it for both did it make sense to me, was it reported in a way I felt was defensibly reflected in the quality and nature of the work being undertaken.

Thank you.

MR O'DONNELL: Is there anything more we can get from that paper?-- No.

Thank you. Can I take you to Mr Babister's report please? Page 30. Paragraph 104, particularly the second sentence?-- Right.

He says, "Flows releases from the Wivenhoe Dam were the major component of the flood peak" referring to the flood peak in the Brisbane River." Can you tell us in your opinion could someone reliably make that statement without doing modelling work?-- I wouldn't. I think it is a surprisingly complex - it is a surprisingly complex study. As I was indicating earlier in my testing, when I think about it in terms of where the rainfall falls in the catchment, what proportion falls downstream and where the intensity of those rainfalls are, that would suggest from a rainfall analysis that there would be a substantial contribution, possibly half or up towards half, from that downstream catchment in terms - predominantly in terms of volumes but understanding how that translates into peaks and the relative timing of that is a very difficult thing to do. Even if you combine that with observed flow data where it occurs there is still large areas of the catchment that are ungauged and you have to infer. To my knowledge the only modelling I have seen is in the figure 8.10.2 I think it is of the Seqwater main report and to me I've - to me that's the best analysis which the qualifiers that were presented there about that relative contribution.

Can we confirm what you are referring to? Do you have a copy of the Flood Report there?-- I don't, sorry. So, I am referring to figure 8.10.2 on page 149.

Yes?-- Now, this was examined, I think yesterday, and the benefit of this representation - and we can talk about its limitations in a moment - but one of the things this figure reflects is that it is based on URBS model which is a model that relates rainfall to flood run-off. This is, in fact, the best means of identifying where in the catchment was runoff generated and where did it flow into rivers. That is the kind of point of this kind of model. So, this would be the best means of looking at where in the catchment did rainfall fall, how some of the loss is worked out, how the travel times, how it flowed down through the system. This is exactly what that model is meant for. If you look at that model it would suggest that the flows downstream of Wivenhoe Dam play a significant role and notionally half that contribution would appear to be from above Wivenhoe rainfall, that is above Wivenhoe, the other half is below it. I think the important qualifiers that have been noted is where the value of the hydrodynamic model would be - would be to ensure we had right both the relative timings of the peak and the exact relative differences in levels associated with that. That's something clearly this model can't do on its own but it certainly is the only modelling I have seen that takes account of where the rainfall is generated from the catchments and how that accumulates on its movement downstream.

All right, thank you. Now, if we could go back to Mr Babister's report, please. Paragraph 140. That is on page 40. The opening sentence, "With the benefit of hindsight it is clear that an earlier escalation of the dam outflow rate would have produced the ultimate peak release discharge downstream of Moggill including the Brisbane CBD." Now, he

doesn't give any details as to what earlier escalation of the discharge rate or over what time in these figures. Can I ask you this: in your opinion could someone reliably draw that conclusion without doing - undertaking modelling work?-- No, because whether or not it is true would depend upon subsequent decisions made about operating the gates. So the concept of releasing earlier and creating more air space would suggest that that wouldn't be able to absorb more of the rising limb of the flood and reduce the outflows but unless you know what their subsequent decisions around gate operations were it is hard to know whether that is true or not. I wouldn't be prepared to comment on that.

Does the extent of flooding in Brisbane - is it affected by the volume of the releases as much as the rate of release?-- It is both. The level in Wivenhoe Dam is very much a function of both volume and peak of the inflow floods. The flood levels downstream, volume will also still play an important factor in that because of what I was saying earlier about the ability of the flood plain to absorb that water. So, the dynamics of how the flood plain absorbs that water and then releases it back into the stream as a flood is very much an issue - a combined issue of both volume and peak.

Thank you. Could you please turn in his report to paragraph 47? It starts on 16. He is talking here about weather forecasts from the Bureau of Meteorology. Particularly the last sentence I wanted you to focus on, "It is only in recent times the information value in these forecast products has had enough utility for it to be considered in the quantitative way in decision making." Could we focus on the timing of January this year? Where he talks about using the forecast in a quantitative way in decision making in operating the dam during a flood could you understand what you understand he is referring to by the term "quantitative"?-- I inter that statement to mean that the forecast is provided in a way you can input it into a rainfall run-off model and then use it to predict floods over that forecast period. That would be information on depth of rainfall and then you would have to either make assumptions or be told about how that depth of rainfall was distributed in time and in space. You need those three attributes. You need to specify those three attributes to put it into a flood model. To me that is what I infer as the determine quantitative.

What is the reference in relation to decision making in the operation of the dam during the flood event?-- I infer that it is suggesting if we had - if we had forecast - quantitative forecasts of rainfall therefore we could get quantitative more refined information on the flood inflows which would then help influence the decisions made around the gate operations.

All right. Have you had experience of other flood mitigation dams in Australia to the extent to which they have used weather forecasts in making quantitative decisions about management of a flood event?-- I don't know of any dam owning agency in Australia that is using rainfall forecast quantitatively. We are working with one Asian city at the

moment to explore whether or not that's feasible but I don't know of anyone who is actually using it.

Have you had actual experience of some flood mitigation dams in Australia and the manner of which they make decisions about managing flood events?-- My expertise is more in assessing flood risk for dams rather than their operational behaviour so I don't tend to get involved in decisions around gate operations procedures. But, through my experience - as I said, I have worked in every State and Territory on numerous dams and my knowledge of both the agency operating the dam is I haven't ever had - I have never come across anyone actually using this quantitatively.

Have you looked at the weather forecast that the engineers received during the January event that are annexed in the Flood Report?-- Yes.

Go back and look at them again if you wish to?-- Yes, no, I think I am right.

Can you offer a view as to whether more reliance ought to have been placed upon them in making actual decisions about dam releases and switching between strategies during the January event?-- I certainly looked at those forecasts and I think one of the most striking things about the forecasts are they are, in one sense, quite volatile. They make successive repeated forecasts over successive days. To plot them up as I did in the report, SKM report I tendered - can I draw your attention to that, would that be helpful?

Yes, please?-- Figure 4.3 on page 15 of the SKM report. I think the thing that is striking about that, and this is simply a plot of the information provided by the Bureau that - to Seqwater. The two - from a modelling perspective it appears that the - there is this, kind of, oscillation in the forecast for successive days which would indicate something about the way the models are being initiated or the way they are being run is that there is some - you would expect there to be persistence from one day's forecast to the next. So if there was a large rain forecast for a three day period from today you would expect there to be a strong correlation or overlap with that same forecast the next day. Physically that is what you would be expecting. To bounce around like that would suggest to me undermines the uncertainty in the nature of the rain forecast being provided. Also I think that was reflected in - there was another plot which isn't coming to hand immediately but there was another plot which illustrated also it did oscillate from one day to the next in the first part of the event. There was a sort of 40, 50 per cent underestimation in the latter part and an overestimation. I think people are aware of that. There was a plot, I thought it was in this report, that illustrated that graphically.

Not the one on page 14?-- Page 14 figure 4.2.

Just explain that, I had trouble following that?-- It was meant - I was trying to make that clear, in fact, what was

happening, so apologies. What that is indicating is that from one - it is actually putting on, if you like, a time scale; the forecast 24 hour rainfall against the actual 24 hour rainfall. So what you will see is the arrows show how those forecasts proceed in time throughout the event. You will see the numbers next to the points indicate the dates. You can see that on the, let's say the 6th, which is the sort of bottom third of that plot there is a dot which sits on that dotted line which would indicate on the 6th the forecast rainfall of 40 millimetres was quite close to what actually happened for the subsequent 24 hours. As you step forward in time, you will see around the 9th and 10th which was the rainfalls most relevant to the extreme part of the event. Those forecast rainfalls that was being forecast around, say, 50 odd millimetres whereas the actual was three times that. So, any points plotted up to the top left-hand part of the plot show an underestimation, and to the right-hand overestimation. From the 10th the two - the solid and the open lines, those forecasts are provided every 12 hours, so one is in the morning and one in the evening. So, from the 10th you then jump to the 11th which is starting to run on the recession limb of that flood. You then suddenly see that forecast rainfall is now probably over double what actually occurred. So when I look at that, both the lack of physical reasonableness in the progression of the forecast and the behaviour during the event, to me that is consistent with the Bureau's statements about their concern around the accuracy of that - those forecasts.

All right, my question was really asking for your opinion as to whether the flood engineers in managing the January event ought have placed more reliance on the weather forecasts when making quantitative decisions?-- On the basis of this I would have been very reluctant to place reliance on it.

COMMISSIONER: From a lay person's point of view, though, if you are coming up to 74 in the lake level it seems very sanguine to proceed on the basis that there will be no further rainfall when it is actually forecast?-- I understand that point. The problem with it is you could see if you put any weight on it the early part of the event you would probably would have been holding water back and in the later part of the event you then would have over released so I think illustrates in my mind why it would be quite difficult to rely on one forecast and weight it in some way. So, I think the much better way of dealing with this is to actually get an ensemble or range of forecasts from the Bureau and that could reflect either differences in assumptions in how it was run, actual different model outcomes so you actually get, say, a range of forecasts and then you can run them through a model and get a much better sense of where that uncertainty and how that uncertainty would impact on decision making.

I think that's the sort of thing Mr Babister is talking about, too?-- Okay.

MR O'DONNELL: Just taking up the Commissioner's point though. If you are the flood engineer and the lake level is rising and

it is going towards 74 but not at 74 yet, if you jump to a W4 strategy you are going to result in very large releases, coupled with downstream rainfall and contributions from the Lockyer and Bremer almost certainly widespread flooding in Brisbane. On the other hand, if you don't jump to a W4 and the rain stops, so the forecast proves unreliable and the rain doesn't come you might get the dam through without having to go to a W4 strategy. You might thereby avoid greater flooding in Brisbane. Wouldn't you have to weigh those two options?-- Yes. I do think - the difficulty is how you weigh it when - if you only have one forecast. You don't - if your previous experience in that forecast is that it is inaccurate, it is hard to know do you assume all forecasts are going to be half the actual? How do you - I can't see how you can make any - use that information in an informed way during the event. So, that's why - and it is suggested in the report the sense of having an ensemble would give you a much better understanding of how resilient your decision would be to the likelihood of what the possibilities might be.

Might it also highlight that the draftsperson of the manual specifying you go to a W4 strategy when the lake level actually crosses the 74 line has some commonsense to it.

COMMISSIONER: Sorry, what was the last part of the question?

MR O'DONNELL: That it had some commonsense to it.

COMMISSIONER: That's if that is what they did say. That is one view of it.

MR O'DONNELL: Yes, it is. It is a view all the engineers have expressed.

COMMISSIONER: Yes, it may or may not be the correct view but if that were the view.

MR O'DONNELL: Yes?-- I don't feel I can comment on that. I haven't looked at that in any detail, the operating procedure.

COMMISSIONER: Very prudent. It will only confuse you.

MR O'DONNELL: Can I ask you to look at the Commission's list of suggested work to be done on the manual revision, Exhibit 408?-- Yes.

I just ask you to comment on a couple of items regarding forecasts. I am in the long term part?-- Right.

I am looking at paragraphs 11 and 12?-- Right.

Can you comment on whether you think that is a wise thing to be considering?-- Look, it is a very desirable end state. I see there are two steps to it or two parts to it. First of all, I think the Bureau needs to be able to provide a forecast service with some parameters around uncertainties or defensibilities of what those forecasts are. Having done that, I think it is up to then the user to determine whether

or not that form of forecast service is actually fit for their purpose. So, it seems to me you would only consider steps 11 and 12 once you had - after the Bureau had actually provided forecasts in a way that they were comfortable with. As I said earlier, I think the only way that can be done is in an ensemble framework. Then I think there is that step which I think is probably the point of 11 and 12 is to then assess whether or not that is useful, fit for purpose. I don't think you can - the short way of saying that is I don't think you can really assess the efficacy of those rainfall forecasts until the early work has been done by the Bureau.

As far as you know to date the Bureau has not been issuing ensemble rainfalls?-- I am aware they have - it is under consideration but they have not been issuing them in that form.

Just one last thing about the hydrodynamic model. You answered some questions earlier about that. You said the hydrodynamic model, its use is looking at an area where there is least uncertainty from the point of view of the flood engineers. Would you mind explaining that?-- The point I am making there is during a flood crisis like January, you have got - there is a lot happening. Of course, we - most uncertainty during that event was how much rainfall was occurring, was likely to fall, and where was it and where would it be falling? I think one of the things that is pretty evident really through the Seqwater report is that they, I thought, did a really very good job of analysing all those possibilities, they kept on doing these different scenario runs, these what-ifs. That is a really useful tool for trying to assess what's the likely response of this catchment to all the uncertainty I am faced with? Now, the impact of the - that kind of uncertainty about where rain falls, how much it, is much much greater than the difference in uncertainty between flood levels predicted downstream between the hydrological model and a hydrodynamic model. I think particularly during the flood crisis you want to focus your energies on where there is most uncertainty and take account of it and if you have the luxury of then doing the finessing absolutely go to something, you know, refine those parts of the problem that need the more accurate inputs when you have got the time to do so.

Thank you.

MR CALLAGHAN: Could I take you to one point at paragraph 140 of Mr Babister's report? You were taken to that a moment ago. It is probably on the screen-----?-- Yes, I can't find it, sorry.

-----if you can't find your hard copy?-- Yes.

In the second line of paragraph 140, if the word "would" was deleted and in its place the word "could" was substituted, thereby embracing your qualification that the validity of the proposition might depend upon subsequent decisions in opening gates, would you let the sentence pass in those circumstances?-- As I said, we are moving to an area about operations of the dam which I haven't - I haven't focussed on. So if I can heavily qualify my answer with that, then I would say "could" would make me more comfortable.

It is probably another way of saying anything is possible in hindsight, is that right?-- Yes.

Thank you. I have nothing further. May Dr Nathan be excused?

COMMISSIONER: Yes, thanks, Dr Nathan. You are excused.

WITNESS EXCUSED

MR CALLAGHAN: I call Colin Apelt.

COLIN JAMES APELT, ON AFFIRMATION, EXAMINED:

MR CALLAGHAN: Could you tell the Commission your full name and occupation, please?-- My full name is Colin James Apelt. I am now retired. I am a professor emeritus of the University of Queensland in the field of civil engineering but I work part-time doing specialist consulting work as and when I am persuaded to do that.

And you were persuaded, for the purposes of preparing a report for this Commission, on behalf of Seqwater, is that correct?-- That's correct, yes.

That report is now Exhibit 410. I just have a couple of questions arising from it. If I can take you to the conclusion on page 3 at point 4?-- Yes.

COMMISSIONER: There is a little screen there, too?-- Good. That's even better. Thank you.

MR CALLAGHAN: I just want to be clear were you in fact briefed with a copy of the manual?-- I am not sure what you mean by briefed?

Did you have a copy?-- Yes, I had a copy of the manual, yes, and what's called an uncontrolled copy was given to me, yes.

Did you form a view as to whether the manual compelled the choice of strategy, that is strategy W1 through to 4 - whether the manual compelled that choice to be informed by forecast rainfall?-- Not compelled, no.

Your view was that it was not-----?-- Not compelled, no.

-----necessary?-- No.

All right?-- I could expand on that if you wish.

Well, you formed your view?-- Yes.

And the other questions I had depended on whether your view was to the contrary so I don't really need to go any further. Thank you.

COMMISSIONER: Now, Mr O'Donnell, you will be going last again, I take it?

MR O'DONNELL: Yes, thank you.

COMMISSIONER: Mr Ambrose?

MR AMBROSE: We have no questions.

COMMISSIONER: Mr Rangiah?

MR RANGIAH: In order to answer the question you were asked, you had to interpret the manual for yourself, is that right?-- That's correct, yes.

And the answer to your question - sorry, the answer to the question that you were asked was influenced by your interpretation of the manual?-- That is correct, yes, yes. The manual is written in such a way that it requires interpretation.

Thank you. I have nothing further.

COMMISSIONER: Mr Porter?

MR PORTER: No questions, Commissioner.

COMMISSIONER: Mr Murdoch?

MR MURDOCH: No questions, thank you.

COMMISSIONER: Ms Brien?

MS BRIEN: No questions, thank you.

MR MacSPORRAN: Nothing, thank you.

COMMISSIONER: Ms McLeod?

MS McLEOD: No questions, thank you.

COMMISSIONER: Mr O'Donnell?

MR O'DONNELL: There is nothing from the Commission?

MR CUMMINS: No, thank you.

COMMISSIONER: Thank you. Mr O'Donnell?

MR O'DONNELL: You were asked about whether a choice of - between strategies and release rates was compelled by forecast rainfall on your interpretation of the manual. You said not compelled but you could elaborate?-- Yes.

Would you mind elaborating for me?-- Well, if you will allow me to say more than a few words?

Yes, sure?-- In my view, the definitive statement about that manual is a set of objectives which are repeated three times, and perhaps, you know, if it could be shown up on the screen that would be helpful. Section 8.

Sure?-- I would like to look at. Is that available?

COMMISSIONER: Yes, we can do that.

MR O'DONNELL: Or you could see a paper manual if you prefer?-- Well, is it here? I would like the - I know the report itself has extracts but the full manual - thank you.

COMMISSIONER: When you say the report has extracts, I got a very abbreviated report from you which doesn't seem to have extracts from anything?-- This is Seqwater - I beg your pardon, Commissioner, I was referring to the Seqwater report.

Thank you?-- No, no, my report was very brief. It is section 8.4 of the manual. And the first part of that states very clearly the objectives and it also states very clearly that consideration is always to be given to these objectives in descending order, and that, I take, as defining the statement about what's to be done. The strategies then are chosen to achieve those objectives but the appropriate choice of the strategy is going to depend on what is stated there on that middle paragraph, "depend on the actual levels in the dams and the following predictions which are made using the best forecast rainfall and stream flow information available at the time." So the strategy depends on all of those things, and in my view all that has to be taken into account before - and the specific matters are itemised there in the three dot points. The general understanding I have from that manual is that once you have crossed a threshold level, you must implement that strategy, but whether you actually implement the strategy a little bit before on the basis of forecasting is left to the judgment and the interpretation of the people operating the dams. And the only very specific statement about dam levels is on page - relating to strategy W4 which - okay, the - under the box there, the intent of the strategy - sorry, "The strategy normally comes into effect when the water level in Wivenhoe Dam reaches 74.0 metres." That's a very clear statement, in my view, and that's the definitive one in terms of making that very serious transition into W4. There is a provision which requires the implementation of the powers of discretion, through section 2.8, to act before that, but the - the situation then is are you certain that you are going to cross 74.0, then you must invoke W4, and "certain" becomes "sometimes" only when you have actually passed 74 but in the case of this event there was a whole accumulation of information just before that situation, which indicated, "Yes, we're going to cross 74, we should start acting." And the manual is written by engineers for engineers, and it draws - tries to draw on the experience of people who have operated the dam and it is the best effort of the people involved to actually set down that experience to guide future operations. And in that context, I think it is important to realise that the people who wrote that manual had never actually managed the situation that called for W4. All of the - there have been large floods since 1974, and there was one large one in the 1990s, which we had - the whole of the rainfall was above Wivenhoe Dam, virtually, and the city - the people of Brisbane would have been unaware of what was happening if they weren't watching the river, which flowed for some long period of time well above its normal level but within its banks. I was told

that particular flood event - I don't recall the exact year - had a volume not unlike that of 1974. So the experience, what has happened in this flood is venturing into an area that was being explored for the first time once they had to go to W4.

Could I ask you another aspect of the management of the January event? You saw from the flood report there was a lot of modelling being done by the flood engineers in control of the event, and the model results, some of them are in the flood report?-- Yes.

Do you have a view as to what role that modelling should play in the judgment decisions made by the engineers when managing a flood event?-- Yes, yes, I do. And if I could just make - you know, an introductory comment? I have done a lot of work with modelling - not hydrological modelling, but other types, including the hydrodynamic - and I know their limitations. I have great regard for their value, but the thing that I have always tried to instruct my colleagues and students with is that models are not designed to tell you about reality. They give you a good approximation - the very best models give you a good approximation to aspects of reality, and in the use of the RTM it is about aspects of reality that might occur in the future. So they are, in my view, and virtually all modelling is intended to provide - to inform and provide an assistance to the exercise of judgment. It would be inappropriate, in general, to take the absolute numbers from a model and act on them.

All right, thank you. Something I forgot to do was your CV?-- Yes.

Do you mind if I do it now?-- If you wish.

Can I hand you a copy?-- Thank you.

It appears from this you have had a long history of involvement in the operation of the Brisbane River, flooding of the Brisbane River?-- River - flooding in the river, yes. And I make the distinction between that and the actual operations of the dams. I have not been involved specifically in that but certainly the behaviour of Brisbane River floods, yes.

But you have had some involvement with the Wivenhoe Dam over the years?-- Not specifically on the management of the dam in its operations, no.

No, not the management but some aspects - can I show you some - in fact you mentioned it, I think, in your list. If you go to page 3, the fifth item down, Review of Brisbane River flood study?-- Yes.

Could the Professor see Exhibit 401, please? If you look on page 6 of that exhibit?-- Yes.

You will see your name on page 6?-- I don't seem to have the right same page as you. This is the Brisbane River and Pine

River Flood Study.

Yes, that's right?-- My page 6 - I don't see my name, I am sorry. Maybe there are different paginations. Could you give me-----

There is a (vi) in Arabics. I am looking at the Arabic one?-- So am I but my Arabic 6 is table 3.2 at the top. I don't see any - can you tell me - I don't see my name there.

COMMISSIONER: Mr Dollar, would you oblige by just taking that and showing it to Mr O'Donnell? Thank you. I don't mean to make you bailiff but you are nearest.

MR O'DONNELL: I think that's not-----?-- Excuse me, could I inquire are you talking about the Review of the Brisbane River Flood Study?

Yes, I am?-- That's a totally different document. That's not that one.

Sure. We will show you a copy.

COMMISSIONER: I will get that retrieved, I think, since it doesn't seem to be useful.

MR O'DONNELL: Thank you.

WITNESS: Sorry, the one you drew my attention to is not this document, it is the-----

MR O'DONNELL: All right. So this is something different from that?-- That's correct. It is certainly in my list of-----

All right. Well, Exhibit 401 is a document called Brisbane River and Pine River Flood Study?-- Well, I have that one now, yes.

And you are looking at the executive summary?-- Yes.

If you look on page 6-----?-- Yes.

-----your name appears as part of the review panel?-- That is correct.

And that was reviewing the overall flood study methodology?-- That's correct, yes.

And that study looked at, amongst other things, the hydrology used in the Wivenhoe Dam operations?-- That's correct, yes.

More recently - you can put that down now - more recently you have been part of a body formed by the Queensland Water Commission to look at the question of raising the full supply level in Wivenhoe?-- That is correct, to the extent that I accepted the Commission to participate in that but no work has been done on that.

Sure, right. Thank you very much. I will tender the CV, Commissioner.

COMMISSIONER: That will be Exhibit 421.

ADMITTED AND MARKED "EXHIBIT 421"

MR O'DONNELL: That's all I have, thank you.

COMMISSIONER: Thank you.

MR CALLAGHAN: I have nothing arising.

COMMISSIONER: Thanks very much, Professor Apelt. You are excused.

WITNESS EXCUSED

MR RANGIAH: Commissioner, just before the next witness is called, I wonder if I could just indicate that I am conscious that the Inquiry has a massive task to complete in a very limited space of time, and I am anxious not to take up more of it than I need to.

I have previously indicated in Court practice direction 3 that I wanted to cross-examine Greg Rhodes and Leonard McDonald who are both hydrologists. Both of them have provided reports on the question of whether the releases were in compliance with the manual.

They have both acknowledged that there are some difficulties in the interpretation of the manual. Ultimately, I will be submitting that whether there has been any breach of the manual really depends on its interpretation.

On that basis, I am content not to cross-examine them and take up any more time than is necessary. I don't know if anyone else has asked for them to be available.

COMMISSIONER: So are you saying you don't want them because it is really a matter of interpreting the manual which the Commission will do?

MR RANGIAH: Yes.

COMMISSIONER: That's the effect of what you are saying?

MR RANGIAH: Yes.

COMMISSIONER: I don't think they were listed for today, is

that right?

MR CALLAGHAN: I beg your pardon?

COMMISSIONER: I don't think they were expected to be called?

MR CALLAGHAN: No, and for the reason identified. That's the view we took, that, yes, they had their opinions. We all have those.

COMMISSIONER: I am not sure how Professor Apelt escaped that barrier but-----

MR CALLAGHAN: Well, he had other - well-----

COMMISSIONER: All right.

MR CALLAGHAN: -----we were specifically provided with his report by Seqwater. We were happy to call him as a result. I now call Ken Schmidt.

COMMISSIONER: Is Mr Schmidt the last witness for today?

MR CALLAGHAN: He is.

COMMISSIONER: So we will just proceed through.

MR CALLAGHAN: I think so. I don't anticipate - I am certainly not going to be long with him myself. I can't speak for the others.

KENNETH ROY SCHMIDT, SWORN AND EXAMINED:

MR CALLAGHAN: Could you tell the Commission your full name, please?-- Kenneth Roy Schmidt.

And you are a member and Chairman of the Mid-Brisbane River Irrigators Incorporated, is that correct?-- That's correct.

Mr Schmidt, you have prepared two statements for the purposes of the Commission. The first in the form in which most parties would have seen it was dated 9 April 2011. That's been re-executed as of today to tidy up some formal amendments, is that correct?-- Yes, that's correct.

In substance it is still the same?-- Exactly the same.

And contains the same attachments?-- Yes.

I tender that.

COMMISSIONER: That will be Exhibit 422.

ADMITTED AND MARKED "EXHIBIT 422"

MR CALLAGHAN: And what's been referred to as your second statement was actually one executed on 13 May 2011, is that right?-- Yes, that's correct.

Yes, I tender that.

COMMISSIONER: Exhibit 423.

ADMITTED AND MARKED "EXHIBIT 423"

MR CALLAGHAN: In the statement that bears today's date now, in any event the one to which the relevant correspondence is attached, you point out that you wrote to the Minister, Mr Robertson, on the 23rd of December 2010?-- Yes, it was in the form of an email.

And that correspondence is attached to your-----?-- Yes.

Amongst other things in that letter you included the suggestion that during the wet season, the level of Wivenhoe Dam be drawn down to 80 per cent; is that correct?-- That's correct.

And the other point that you make - sorry, one other point

that you make is that the members of your - of the Mid-Brisbane River Irrigators include people who have experienced floods in the mid-Brisbane River over a period of 60 years?-- That's correct, yes.

And you acknowledge that whilst you don't have technical expertise, there is a lot of history there which you feel should be incorporated into decisions made in this area?-- Yes, that's right.

Finally, it is the case that you are in possession of a DVD which contains some footage of the flood, is that right?-- Yes.

You are going to make a copy of that available and tender it at a later time?-- Yes, I only received it yesterday so, yes, I will.

And that's something that you would like the Commission to view?-- Yes, please.

I can indicate that once that copy is made available it will be available to any other party who wishes to view it as well?-- Thank you.

Those are my questions.

COMMISSIONER: Thank you. Mr-----

MR O'DONNELL: No questions, thank you.

COMMISSIONER: Mr Ambrose?

MR AMBROSE: No questions.

COMMISSIONER: Mr Rangiah, do you want to go last? Sorry, no, I am getting mixed up. Mr Rangiah?

MR RANGIAH: I don't have any questions.

MR PORTER: No questions, Commissioner.

COMMISSIONER: Thanks, Mr Porter. Mr Murdoch, we will leave you till last. Ms Brien?

MS BRIEN: No questions, thank you.

MR MacSPORRAN: Nothing, thank you.

MS McLEOD: No questions, thank you.

COMMISSIONER: Mr Murdoch?

MR MURDOCH: Mr Schmidt, just very briefly by way of background, you're 44 years old?-- Yes.

You and your father work a 600 acre farm on the banks of the Brisbane River, some 14 kilometres downstream of Wivenhoe Dam, is that right?-- That's correct.

And is it the case that the farm has been worked by generations of your family since about 1933?-- Yes.

And is it also the case that your family have been farming in that area of the State since the early part of last century?-- Yes.

And are you able, from historical markings on the farm, to compare the flood level for the '74 flood with the flood level peak of the January 2011 flood?-- Yes, we're very well aware of where the '74 flood came to. I was only young but I still remember it. And the January 2011 peak was approximately a metre to a metre and a half higher on our farm than what it was in 1974.

Now, given that it is a large farm, the reference point for which you have taken that comparison, whereabouts is it on the farm?-- It is - basically, our farm consists of a river flat and then a hill to one side. Well, it is up on the level of the hill where the water came in 1974. So it is on a higher level - a higher part of the farm, basically. Probably the highest part of the farm.

Now, post flood, post the January flood, what is the current state as of today of your farm?-- Not exceptional. It is still in a mess. We received a huge amount of damage. The damage this time was far greater than anything I have ever witnessed and anything that my father has ever witnessed. We're unable to still work our bottom flat, our river flats, which is probably a third of our farm. It is - we have no power on the river bank as yet, so we can't irrigate with our equipment. Our equipment is not in the river anymore because it is - we had to take it out. We do that each time it floods, we have to lift our pumps, but this time we had to take them right out and dewire them, but there is no power there anyway because the power lines are all knocked over, the power poles are all knocked over. Yeah, it is - our farm is probably at a third of its production and probably will be for another six to eight months before we can get it back to full production, maybe even longer, depending on how long it takes Energex to get the power back on.

All right.

COMMISSIONER: What do you farm exactly?-- We run cattle and we grow small crops, vegetables, sweet corn, beans, that type of thing.

Thank you.

MR MURDOCH: You have traversed in your second statement your observations in relation to three residential developments in Fernvale. That's Brookside, Poole Road and Schmidt Road. Are you able to give an observation as to the state presently of the flood damaged properties in those three developments?-- Yes, that's basically the urban part of Fernvale that was inundated during the flood event and it really hasn't recovered a great deal. There is still a lot of vacant houses. Most of them have been stripped of all their Gyprock and have just got their windows open and no-one residing in them. They are slowly - they are slowly getting back. I think insurance is a major drama there. People are slowly getting back into their houses, but, yeah, it is like a ghost town at night now. There is really, really nothing there in those areas. They were devastated. They had up to a metre and a half, probably two metres in places of water through them. So, yeah, it is going to take a long time for them to get back to normal.

All right. And, lastly, the current state of the river in the area adjacent to your farm, what's your observation as to that?-- Well, the damage, I think, is irreparable. I had to have a little bit of a chuckle when I heard that DERM had given 200,000 towards repairs. I mean, it is more like - probably, you know, in the vicinity of tens of millions of dollars worth of damage that needs to be repaired. There is areas that will never be the same. We have - we have areas of river - well, where one of my pumps is, the suction pipe used to go into the river probably five metres, now it is ten metres from the river. So the river's course has changed in places. You witness that in my - in our report and in my witness statement there is photos there that show where people's properties have just been basically washed away, and there is trees there that I have been told were there, have been there for hundreds and hundreds of years that are now just flattened, large gum trees that I can't get my arms around are gone. The force of the water was just incredible. I have never seen anything like that in my life. In fact, the speed of the water was amazing. The water itself - the river itself had like a convex shape to it. The centre of the stream was probably a metre, metre and a half higher than the outside of the stream because it was travelling that fast, and in a lot of areas, the flood height was a metre, two metres, two and a half metres higher in the river bed and just adjacent to the river bed than what it was in '74. Yet, out on the wider plain, that they call the attenuation basin, so I have heard now, the water was nowhere near as high as '74 because the water just went through so quickly. It just - it didn't have time to spread out. I mean, it did spread out in places but in other places it didn't. And when you hear locals who went through both flood events, the only way they can explain it is the fact that the water was just moving so fast because it was coming from such a huge height compared to '74. I mean, '74 was a natural event. It came through in - you know, it was slow up and slow down, whereas this one was basically - it came through in one big hit in two hours, or three hours, and then it was gone. And if anybody knows

anything about hydraulic drawdown, that's basically the big cause of it and I think a lot of the cause of the damage on the river was the fact that it was - that peak release was so fast and cut off so quickly that the river banks were saturated and the hydraulic drawdown just drew the side of the river bank straight into the river and, of course, it has ended up in the bay.

Nothing further.

COMMISSIONER: Mr Callaghan?

MR CALLAGHAN: No, nothing arising. May Mr Schmidt be excused?

COMMISSIONER: Yes, thanks, Mr Schmidt, you are excused.

WITNESS EXCUSED

MR CALLAGHAN: I will take the opportunity to tender-----

COMMISSIONER: Is there a list of these-----

MR CALLAGHAN: There is.

COMMISSIONER: -----because the easiest thing might be just if I read the names of the witness statement and the Exhibit number.

The statement of Robert Reilly will be Exhibit 424. That if Emma Thomas, 425. Barton Maher, 426. Jim Pruss, 427. Graham Keegan, 428. Brett Schultz, 429. Rob Drury, 430. Daniel Spiller dated 13 May 2011, 431. Daniel Spiller dated 17 May 2011, 432. James Charalambous, 433. Don Carroll, 434. Chris Lavin, 435. Santina Pennisi, 436 and Evan Caswell, 437.

ADMITTED AND MARKED "EXHIBITS 424-437."

MR CALLAGHAN: Thank you, Madam Commissioner. That is the conclusion of this segment of evidence. I submit the Commission should be adjourned to Ipswich tomorrow.

COMMISSIONER: At 10?

MR CALLAGHAN: In the absence of any other suggestion, yes.

COMMISSIONER: We will go for that. Adjourn until Ipswich at 10 o'clock.

THE COMMISSION ADJOURNED AT 11.34 A.M. TILL 10.00 A.M. THE FOLLOWING DAY AT IPSWICH