T R A N S C R I P T

LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

Inquiry into the 2022 Flood Event in Victoria

Melbourne – Wednesday 6 December 2023

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WITNESSES

Chris French, General Manager, Victoria, and

Amanda Gilfoyle, Business Group Leader, Water Resources, GHD.

The CHAIR: Welcome back to the committee's public hearings for the Inquiry into the 2022 Flood Event in Victoria, and welcome to our new witnesses.

I will just read this brief statement on your evidence. All evidence taken is protected by parliamentary privilege, as provided by the *Constitution Act 1975* and the provisions of the Legislative Council standing orders. Therefore the information you provide during the hearing is protected by law. You are protected against any action for what you say during this hearing, but if you go elsewhere and repeat the same things, those comments may not be protected by this privilege. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament.

All evidence is being recorded, and you will be provided with a proof version of the transcript following the hearing. The transcripts will ultimately be made public and posted on the committee's website.

I might ask committee members to introduce themselves, starting at that end of the table.

Rikkie-Lee TYRRELL: Thank you. Rikkie-Lee Tyrrell, Member for Northern Victoria.

Wendy LOVELL: Wendy Lovell, Northern Victoria Region.

David ETTERSHANK: David Ettershank, Western Metropolitan Region.

Samantha RATNAM: Samantha Ratnam, Northern Metropolitan.

The CHAIR: I do not know whether Jacinta Ermacora from Western Victoria Region is with us at the moment; she was just in and out. Anyway, I am Ryan Batchelor, Member for Southern Metropolitan Region and Chair of today's hearings. What a year – I am still trying to figure all that out.

Representatives from GHD, thank you very much for coming in today. We welcome you to make an opening statement of no more than 10 minutes, then we will ask you questions. For Hansard, before you speak, if you could state your name and the organisation that you appear on behalf of, and I will hand it over to you.

Chris FRENCH: Thank you, Chair and committee members, for your time today and for providing us with the opportunity to address you. My name is Chris French, I am the Regional General Manager for GHD here in Victoria, and with me is my colleague Amanda Gilfoyle, who is our Business Group Leader for our Water Resources business group, also in our Victorian region.

First and foremost, GHD would like to express our deep sympathies for anyone affected by the floods in Victoria in October 2022 and the more recent flooding in the north and east of the state.

GHD is a staff-owned, global professional services company established here in Melbourne in 1928. While we have grown to become a leading provider of environmental, engineering, construction and architectural services, we are proud of our heritage, our strong connection to Melbourne and our association with the water industry. Throughout our 95-year history, GHD has contributed to many water management and infrastructure projects, including water supply, irrigation, wastewater treatment and environmental management. GHD has a team of hydrology and hydrodynamic specialists that use various analytical methods, including flood modelling, to assist in designing, planning and assessing such projects.

Having read some of the material that is before the inquiry, I would like to use this opening statement to clarify and explain GHD's involvement in the flood modelling of the Maribyrnong River. GHD was engaged by Melbourne Water, a longstanding and sophisticated client, to undertake a specific scope of work of flood modelling in relation to the Maribyrnong River in 2003. This work was completed within a short time frame within 2003, and these models were handed over to Melbourne Water in its capacity as the lead agency

responsible for flood plain management in the Melbourne area. From what has been said in this inquiry, we understand that these models were then used, updated and modified by others.

I would like to explain the scope and time frame of GHD's work for Melbourne Water in 2003. In short, GHD prepared a base model of what has been referred to as the lower section of the Maribyrnong River, from Footscray Road to the Maribyrnong village. This work was to update the model in use by Melbourne Water at the time and was adjusted to match the Melbourne and Metropolitan Board of Works flood study of the river undertaken in 1986. GHD worked collaboratively with Melbourne Water, and in accordance with Melbourne Water's requirements this work was completed in less than three months. At much the same time, Melbourne Water asked GHD to produce a base model for what has been referred to as the mid and upper sections of the Maribyrnong River. GHD prepared the HEC-RAS model for the mid-Maribyrnong within about a month. For context, I understand another consultant is currently in the process of redoing the modelling for the Maribyrnong River for Melbourne Water and that that will take over 12 months. The mid-reach model is from Plantation Street to the Canning Street Ford, and the upper-reach model is from the Canning Street Ford to Stenson Road. GHD handed the mid and upper model over to Melbourne Water in 2003 along with a series of flood extent maps produced from that model.

I would now like to speak about calibration. The issue of calibration of the models has been the subject of discussion before the inquiry. GHD was instructed by Melbourne Water to adjust the lower model to match the calibrations of the previous MMBW 1986 flood study. In relation to the mid and upper Maribyrnong model, GHD offered to calibrate the mid and upper model to recorded data, which would have included any available records from the 1974 flood. After various discussions with Melbourne Water at the time, Melbourne Water requested that the work be undertaken in a short time frame without calibration, and therefore Melbourne Water did not provide any historical data that may have been available to them. Melbourne Water provided its own flow estimates based on its own hydraulic assessment and terrain data for use in a hydraulic model.

At that point in time, when GHD prepared the mid model, the site which would later become known as Rivervue was a paddock, and to our knowledge no proposal in relation to the Rivervue development existed. Similarly, from the time when the mid and upper model was handed over, the model was owned by Melbourne Water, and again we understand those models were used, updated and modified by others. In relation to the Rivervue development, I would like to make it clear that contrary to what has been suggested by others at this inquiry, GHD was not engaged to undertake any flood modelling in relation to the Rivervue development and GHD was not otherwise involved in any of the decisions regarding the changes to the land subject to inundation overlay planning control or the Moonee Valley planning scheme amendment C151. It is worth noting that the flood maps of the one-in-100-year ARI flood extent produced by GHD in 2003 for Melbourne Water showed extensive flooding at the site which was later developed into the Rivervue development.

I would now like to speak about the Flemington flood wall. As the committee is aware, GHD was involved in the development of the Flemington flood wall in 2003. The flood wall was modelled and designed to incorporate mitigation works that were specifically implemented to offset any impact the flood wall may have otherwise had. GHD was responsible for the detailed design of these works and the modelling undertaken in 2003, which demonstrated that the flood wall, together with the mitigation works, would not have adversely affected the overall flooding. GHD's assessment of the flood wall and mitigation works was peer-reviewed by Dr Bob Keller, an associate professor at Monash University and an internationally recognised hydraulics expert with significant flood modelling experience on the Maribyrnong River and with respect to the modelling of streamlining works. Given the objection of various councils and community groups and their engagement of other consultants to consider the effects of the flood wall and the mitigation works, the proposed works were the subject of a lengthy consultation process prior to their final approval. The mitigation works were constructed in accordance with the requirements of the planning permit issued and included the Footscray Road bridge widening and streamlining works, improvements to the northern railway bridge culverts and the managed re-engagement of the racecourse area as a reserve flood plain storage.

GHD has not been engaged by Melbourne Water to update or provide any further riverine flood modelling on the lower, middle or upper reaches of the Maribyrnong River since handing over the models to Melbourne Water in 2003. As I have mentioned before, we had no involvement with the modelling work in relation to the Rivervue development.

As a final comment on these opening remarks, we would like to emphasise that flood modelling is an approximation of a very complex real-world process, and there is always a degree of uncertainty. The scoping and use of any flood model requires professional judgement and skill, including in relation to how and when it should be reviewed and updated. Flood modelling for a technically informed client such as Melbourne Water is heavily dependent on the client's direction regarding the scope to prepare the model and the availability of input data, such as hydrology, survey and calibration information. It is also a discipline that is continually evolving. Given this context, it is unsurprising that there are competing views from others in the field on the best way to go about doing something, especially something as complex and nuanced as flood modelling.

The methodology, availability of data and technology that are used in flood modelling have evolved significantly over the past two decades, which my colleague Amanda would be happy to discuss if the committee has any questions on this. Given these changes, it is not surprising that the first recommendation in the Pagone report on the Maribyrnong flood event was that models should be reviewed every five years and updated every 10 years or after a major flood event.

I thought it was important to use this opening address to clarify the context in which GHD undertook this work on the Maribyrnong River. GHD stands by the work it did in 2003 as being appropriate for the time and meeting the stated scope and requirements of our clients. I am happy to address any specific questions the committee may have in relation to GHD's work to the extent that I am able to or alternatively to take them on notice. Considering the inquiry's terms of reference, my colleague Amanda has come to the inquiry prepared to share with you some ideas about what might be done to increase Victoria's preparedness in relation to future floods. I thank you for your attention and welcome any questions.

The CHAIR: Thank you very much, Mr French. I am just going to start with a clarification because I did not write it down fast enough. The model you did on the Flemington flood wall, was that in 2000 and –

Chris FRENCH: Three.

The CHAIR: Three. Good. Okay. So you did the Melbourne Water one in 2003 and the Flemington one in 2003.

Chris FRENCH: Yes.

The CHAIR: But they were separate pieces of work.

Chris FRENCH: They were separate pieces of work at much the same time.

The CHAIR: At much the same time. Okay. That is very useful. Obviously that model, that work in relation to the flood wall, recommended and you obviously designed the mitigation things – I do not know what the technical term is –

Chris FRENCH: Measures.

The CHAIR: Measures, yes. There you go. Done. Your model essentially suggested that the combination of the two things would have no overall impact on flooding. Are you aware of any work done since that point that looked at whether that was accurate, verified, borne out by experience? Has anyone gone and looked at the question again?

Chris FRENCH: Not that I am aware of other than what is discussed in the Pagone report, which did talk about the fact that the flood behaved in a similar way to what the model predicted. And I think in his testimony this morning he also talked about the probability that the wall plus the mitigation works did not increase flooding.

The CHAIR: Okay. And have you had a look at to what extent the flooding event in October 2022 behaved in a way that was similar to what you modelled in 2003?

Chris FRENCH: We have not done a deep dive into sort of the flood analysis, no.

The CHAIR: Right. Is that a thing that can be done in the ordinary course of events? Like, would that be a normal thing for people to do?

Chris FRENCH: It is my understanding that Melbourne Water has engaged a consultant to answer a number of the questions, or to fulfil some of the answers in the Pagone report recommendations, and that they are engaging a consultant to do that.

The CHAIR: Okay, that is really useful. Sorry, just to clarify, you mentioned that you were not involved in Rivervue but you had prepared maps in 2003. Was it in 2003?

Chris FRENCH: In 2003, yes.

The CHAIR: That showed that there would be flooding on what became the Rivervue site, and those maps were provided to Melbourne Water, I assume.

Chris FRENCH: Yes. To be clear, we produced the model and a report accompanying the model, and in that report was a series of flood maps that were produced from that model, and they did show extensive flooding in the Rivervue site.

The CHAIR: When you produced it in 2003?

Chris FRENCH: Yes. In the site that was later to become Rivervue. Our report was mid-2003.

The CHAIR: Right. Okay. And you have stated that you have done no work for Melbourne Water since that time on the Maribyrnong.

Chris FRENCH: On flood modelling of the Maribyrnong?

The CHAIR: On flood modelling of the Maribyrnong.

Chris FRENCH: Yes. We do other work for them.

The CHAIR: Yes, I am sure. I have absolutely no doubt that you do that. I might just pivot then to the broader question, I think. Ms Gilfoyle, while you are here: on the terms of reference of the inquiry, how do we make sure that our water systems, rivers, built infrastructure and the like are more resilient when it comes to future flooding events? In your expert opinion, what are the key things that this inquiry should be thinking about and looking at recommending?

Amanda GILFOYLE: We have got some recommendations that can be applied around the flood models particularly, because that is the sort of area that we are talking you through here today. There are a couple of areas that we have some thoughts on. These are really around the efficiency in how models can be prepared and the availability and transparency of data.

My first recommendation and comment is in support of the recommendation that came out of the Pagone report in relation to the frequency of revisions for the flood mapping program. Regular updates of these models are required given the changes in technology that we are seeing, the science of hydrology and that being an evolving field, and also the uncertainty around climate change and the effects of climate change itself, not to mention the changes within the catchments and the developments that do occur. There is also a need for appropriate funding to make sure that these are available to the flood plain managers to see that not only the recommendations from the Pagone report but any continual updates to the models are able to be achieved.

A second recommendation is in how we can gain more efficiencies in the actual flood mapping and also the updating of flood mapping, and we are seeing that Melbourne Water are doing some work on this to continue to improve its efficiency. We see that there is potential for more standardisation in the flood mapping and in updating the processes, particularly in terms of the data storage – how we are storing that and how we can actually continue to access that. To understand and have a consistent approach to the modelling itself, we have a lot of guiding principles – AR&R, technical specifications – and I think, as the committee has heard over these proceedings, there are a lot of nuances when it comes to flood modelling and mapping. So understanding and having a common approach to that helps the efficiency. But also the documentation itself –

The CHAIR: Sorry, just on that, would that be a sort of common set of standards, like best practice or standards for modelling?

Amanda GILFOYLE: It is a set of standards but also an understanding and an interpretation of when an AR&R states something how we are interpreting that in a Melbourne Water context or in a Victorian context. There can be a bit of nuance in how different people understand that.

The CHAIR: Right. So you are saying that in your experience people can read the same report and come up with differing interpretations of what a particular piece of data might be?

Amanda GILFOYLE: That can be, and I think we have all got inherent biases in how we see different things. But there are the guiding principles, the AR&R. There are also recommendations. There is a report, there are guidelines and there is often some interpretation in that – so having an understanding. Also, healthy debate is good to make sure people are interpreting it in a way that is going to be able to protect the community is what we are looking to do.

The CHAIR: We have certainly seen and heard from a lot of people who are very expert in this, and I have no doubt that there are a lot of views. Sorry, continue.

Amanda GILFOYLE: That is all right. The other part of standardisation is documentation. As Chris mentioned, these models come with a report. So if there is a way to actually standardise the report so you are finding the same spot when you are picking up a previous model – this is the report, this is where the assumptions were and the datasets that were applied – you do not actually have to go hunting for it each time. This also all feeds into appropriate version control and the format of how this information is prepared and made available to the end user. This helps with that consistent, ongoing modelling approach.

A final recommendation is in having a central and accessible place, probably controlled by the flood plain manager, where the input data that is used for the models and reviewed raw-model files can be made available to end users so they can take them and apply them to their certain use. We have seen varying ability to gain information over the last 20 years, and having a centralised storage spot will actually make it easier to find past models, to manage the version control as well, and having consistent use of that model. Having appropriate metadata also underpinning this allows then to capture when these models have been reviewed, what overrides or changes have been made to the models and also what assumptions or other underpinning data is there for the models. Using my second and third recommendation in combination actually allows aiding in that efficient implementation of that first recommendation of the frequency in the reviews and updates of the model.

The CHAIR: That is really interesting. How common is the use of proprietary systems and elements of models in the industry generally?

Amanda GILFOYLE: The actual modelling software itself? There is a common platform that is used that Melbourne Water have adopted – that is TUFLOW. It is just a 2D modelling package. I will not go into the nuances.

The CHAIR: Please do not.

Amanda GILFOYLE: And I will not be able to explain it efficiently let alone within a short time frame that we have got here today, but that is the commonly accepted model.

The CHAIR: One of the features that we obviously want to have here is that these types of models not only are standard but they are available to be interrogated and that commercial considerations do not prevent other parties from testing them but also using them and reusing them where appropriate. You do not think that that is – that sort of claim is not a common feature of the industry?

Amanda GILFOYLE: The models are provided to Melbourne Water and then it is up to Melbourne Water how they make them available to others and making sure that they have the appropriate version control. But having that in a spot where it can be stored, cloud-based or web-based, so it is actually more easily accessible for others, would be a recommendation.

The CHAIR: In your experience, are much of the inputs that go into this modelling activity readily accessible and/or common/reused. We have not got competing input data sets here, have we?

Amanda GILFOYLE: It is something I cannot speak on from experience. I know the availability of data has changed significantly over the 20 years, and it is more readily available. We see more available LIDAR

information, which helps you with your terrain models and putting the terrain together. We are seeing more accessible information around rainfall patterns, and as technology has improved we can get that information – it is more easily stored and it is more available. Whether it is conflicting or not, I cannot speak to that personally.

The CHAIR: No worries. I might leave it there. Dr Ratnam.

Samantha RATNAM: Thank you very much for being here and providing your evidence. We are just trying to piece together fragments of information that we have received throughout the course of a number of months of this inquiry, so bear with me in some rudimentary questions. Thank you for outlining the work you did in 2003 – one for the flood wall and one for Melbourne Water, the Maribyrnong study. The flood wall was commissioned by the RC, is that my understanding?

Chris FRENCH: That is right.

Samantha RATNAM: I am not sure when you all began your operation as GHD but are you all able to provide us, even if it is on notice, the times you have been commissioned to do work for Melbourne Water? Do you have a sense of how frequently you are commissioned to do work for Melbourne Water and on what basis?

Chris FRENCH: GHD was established in 1928.

Samantha RATNAM: So long since, it is fine. Yes. That is good.

Chris FRENCH: Ticking up to a hundred years in a couple of years time. We work for Melbourne Water on a regular basis on a wide variety of different projects, from water supply projects to sewage treatment, recycling as well as flooding.

Samantha RATNAM: And to this day, continue to do that kind of work?

Chris FRENCH: Continue to do that, yes.

Samantha RATNAM: Is it possible to get on notice a list of that work? I appreciate some of it might be commercial in confidence.

The CHAIR: Wouldn't that be in your annual report?

Samantha RATNAM: Would it be in your annual report?

The CHAIR: No, no – Melbourne Water's annual report.

Samantha RATNAM: Melbourne Water's annual report? I am not sure; I have not seen that reference.

The CHAIR: Generally contracts over a certain value are required to be reported in the agency's annual report.

Chris FRENCH: I have not read Melbourne Water's annual report recently, but yes, I think they do declare their major contracts. That is correct.

Samantha RATNAM: Major contracts, yes.

The CHAIR: If it is publicly available information, we might be able to access it.

Samantha RATNAM: Yes, we might be able to. Would you all consider providing us with more information, even for those non-major projects? I am happy for you to take that on notice if that is inappropriate.

Chris FRENCH: I would take on notice the consideration of whether we could provide it. Obviously that information would be commercial-in-confidence –

Samantha RATNAM: Yes, I appreciate that.

Chris FRENCH: to GHD, but I think suffice it to say Melbourne Water has been a longstanding client for GHD throughout Melbourne Water's existence, and also its predecessor organisations. So if your question is around 'Do we work for Melbourne Water a lot and have we engaged with them over the years?' – well, the answer is yes. We have worked for Melbourne Water on a range of different projects over a long period of time.

Samantha RATNAM: Thank you. We have had some evidence provided to us that suggests that Melbourne Water changed the way it managed its operations. So whereas prior to a certain time in the early 2000s they would do a lot of the modelling and that kind of analysis work in-house, they restructured and were outsourcing a number of aspects that they previously did in-house. Has that been your experience? Are you able to speak to that at all, knowing the kind of work that Melbourne Water did pre-2003 versus post-2003? Are you doing a lot of work that they would ordinarily have done previously in-house?

Chris FRENCH: I cannot speak to the flood modelling area. I have worked for Melbourne Water for a couple of decades myself. In general, I would answer that question with: Melbourne Water retain a strong expertise in the areas in which they work and employ a range of technical disciplines and technical specialists across the different areas in which they work. Have they changed their methodology and how they do work? I probably could not answer that specifically, no.

Samantha RATNAM: Okay. Can I ask you a question, and it is related to a question that was asked before and which you started answering, in terms of how you maintain some sort of consistency and rigour, granted that there might be different interpretations, but there is sort of a scientific consistency that is required because the implications are so significant for this kind of modelling work. How does the industry alongside the catchment management authorities and the likes of Melbourne Water maintain that kind of rigour and consistency to ensure that when, say, you contract something out – you commission some work to be done – it is at the same standard? How do you calibrate that consistency across the sector?

Chris FRENCH: I think if I was to try and answer that in general, an informed client like Melbourne Water would bid out work, and different consultants and other parties would tender for that work and they would demonstrate their skill sets and their experience on other projects and their ability to deliver to the relevant technical attributes that are required for that work. Melbourne Water or other catchment management authorities or others would review that, assess it and decide. There are also industry bodies in different areas – I am speaking more generally now, not just about flooding – that look at standards. WSAA is one in the water sector that helps develop standards, evolve them over time and ensure that the industry overall is improving. And then there is a series of professional conferences and areas that you would expect in any sort of technical area, where different experts come together, they present papers, they get challenged and peer reviewed or questioned, and overall the state of the art gradually increases. So I have probably answered that question in a few different ways, but that is the most – I do not know if you want to add anything, Amanda?

Amanda GILFOYLE: Yes, in addition to that, Melbourne Water do now require and have – I am not sure of the time frame – peer reviews on the models that we put in. So we will submit a model to Melbourne Water and that will be peer reviewed, and then we take that feedback. Again, we might have some conversations around what that means and –

Samantha RATNAM: For check and balance.

Amanda GILFOYLE: Yes.

Samantha RATNAM: Is that a recent practice, or –

Amanda GILFOYLE: I cannot speak to when it was implemented. Sorry.

Samantha RATNAM: No problem. Are you able to take that on notice, if you are able to furnish us with that information?

Amanda GILFOYLE: If it is available, yes.

Chris FRENCH: It might be a question just to ask Melbourne Water.

Samantha RATNAM: Okay.

Chris FRENCH: As in, when they began that peer review. Obviously we did it back in 2003 on this project.

Samantha RATNAM: There was a peer review process?

Chris FRENCH: There was a peer review process for the model. And yes, we now understand that that standard – that is certainly what happens with the work we do now for Melbourne Water with respect to flood modelling.

Samantha RATNAM: Just relating to what you presented in your opening statement talking about the base model work for the lower section and then the mid and upper sections, you referenced the time frames being relatively short time frames relative to how much time you would normally have or what Melbourne Water now commissions itself to have. Was that a commentary about not being given enough time and therefore some sort of inference on the robustness of the model? Can I ask you what is your reflection on that time frame? Why is that time frame important? Why did you want to communicate that to us?

Chris FRENCH: There are probably a few parts to answering that question, and the two models are different. The lower model, a more reliable model, was calibrated to the 1986 flood study, which included reference to the previous major floods along the Maribyrnong River, so there was data to calibrate the model against and so that model had a higher level of reliability attached to it. The mid and upper model was produced in a shorter amount of time and was not calibrated. As I said in my opening statement, that was discussed at the time. GHD offered to calibrate the model, and Melbourne Water requested that we proceed without calibration at that point. So that model would be inherently not as reliable as the lower one.

Samantha RATNAM: So in terms of how that model is then used – and I know that you said it has been adapted and modified et cetera post the time that you released it – how can the public have confidence in that process? For example, if you have been given a remit not to do that extra step that improves reliability, do you all hand over the responsibility at that point and go, 'Well, we've given you an uncalibrated model. It's got lower reliability than a calibrated one, and now it's over to Melbourne Water to do with it what it should'? Is it communicated to the public anywhere that we know we are now working now with two models, one of which is more reliable than the other?

Chris FRENCH: Certainly it is communicated clearly to Melbourne Water. How that is communicated to the public I could not speak to. I think it is probably worth noting the decision around calibration and whether or not to calibrate a model and the value of calibration is a balance between what data is available to calibrate to, what the model is going to be used for and when calibration might happen. So there are many factors that might have informed that decision.

Samantha RATNAM: Have you ever been commissioned by Tigcorp to do any modelling or any analysis work?

Chris FRENCH: No. As I said before, we have not done any work for the Rivervue development.

Samantha RATNAM: Not for the Rivervue development. So you have never been commissioned by Tigcorp as a company to do any work related to that?

Chris FRENCH: No, we have not.

Amanda GILFOYLE: No, not by Tigcorp – not related to the flooding.

Samantha RATNAM: And in terms of the 2003 work, do you know if that was subsequently used to inform decisions made by Melbourne Water? You said you did not have anything to do directly with the subsequent planning controls and changes, but do you know if that modelling work was used to inform those decisions?

Chris FRENCH: Around the Rivervue development, do you mean?

Samantha RATNAM: Yes.

Chris FRENCH: I do not know, as in with 100 per cent certainty, no. I assume it might have, but I do not know.

Samantha RATNAM: Okay. Excellent. Thank you. I will hopefully get a little bit more time at the end and then come back.

The CHAIR: You will, yes.

Samantha RATNAM: Okay. I will get more. I will come back. Thank you very much.

The CHAIR: Okay. No worries. Ms Tyrrell, did you want to ask any questions before you have to go?

Rikkie-Lee TYRRELL: I am happy to cede my remaining time to Samantha.

The CHAIR: I might go to Ms Lovell.

Wendy LOVELL: I just have one question. You referred to, when you did the modelling for Melbourne Water, Rivervue being a paddock. What was the planning overlay on that paddock at the time, and was it taking into consideration future rezoning for those areas?

Chris FRENCH: It is my understanding that there was a flood overlay over part of the Rivervue site prior to the change in 2016. That is my understanding.

Wendy LOVELL: That is right, yes.

Chris FRENCH: I think that overlay was in place in 2003, but I would need to double-check that to confirm if that was the case.

Wendy LOVELL: Okay. That is all I have.

The CHAIR: That is all you have got? Mr Ettershank.

David ETTERSHANK: Thank you for coming along today. It is much appreciated. You did the flood wall modelling – obviously there was a fair bit of controversy at the time as to that, and I understand you got Professor –

Chris FRENCH: Keller.

David ETTERSHANK: Keller to validate it. Then you had other hydrologists who were strongly against it, and I think they also brought in the US Army engineer corps to say that that was inappropriate methodology. No-one on this side of the room would have any capacity to make a judgement, but I guess the question that is in my mind is: having made those recommendations for mitigation or offsets, did anybody check and see if it was right? Was it ever validated that your assumptions and your modelling were correct post 2003? Sorry, I am probably expressing myself poorly; it is getting late in the day. But having done your research, having suggested you could work on those northern rail culverts, you could get some stuff on the Footscray bridge – 'Bammo, it's all sweet, this will offset that and everyone will live happily ever after,' except of course they did not – I am just sort of wondering: was your research ever validated, not by peer review but in terms of actually measuring subsequent inundation and whether or not those offsets you recommended worked as was proposed?

Chris FRENCH: I think the best answer to that is the recent floods and the opinions, I guess, that were expressed in the Pagone report that suggested the modelling and the flood were correlated really closely. That gives I guess a strong indication that the flood wall and the mitigation works combined did not overall increase the level of flooding.

David ETTERSHANK: I mean, the wording in the report is – putting aside the good judge's words this morning – actually significantly more circumspect than what was suggested today, might I respectfully say. And obviously between 2003 and 2022 there were a number of inundation events that occurred. Are you aware of whether or not there was any validation in those subsequent rain events?

Chris FRENCH: No. I am not aware of any validation in those subsequent events.

David ETTERSHANK: Okay. All right. Thanks. You did the 2003 modelling. Could we get a copy of that report, the 2003 mid-Maribyrnong report?

Chris FRENCH: Sure. Sorry, I had assumed you would already have had one.

David ETTERSHANK: No, but we would like to get one, if that is possible.

The CHAIR: We have seen one of the 2003 reports. One of them was attached to the VRC submission. The others were in the Melbourne –

David ETTERSHANK: We might take that on notice. We will go back through the secretariat on that one.

The CHAIR: I just know I have seen a 2003 GHD report, but there were two.

David ETTERSHANK: I think there was sort of a summary report, but I assume there was a substantial qualitative type –

Chris FRENCH: There is a report. Yes.

David ETTERSHANK: Yes. I think we have seen one. It might have been the executive summary or something. Okay.

The CHAIR: Right. Okay.

David ETTERSHANK: All right. If we could, that would be great.

Chris FRENCH: Generally speaking, we do not provide reports that we have given to our client. They are our client's report.

The CHAIR: It might be a better question for Melbourne Water.

Chris FRENCH: It might be a better question asked to Melbourne Water, but certainly I do not imagine they would have a problem with you having a copy of those.

The CHAIR: We could ask them. We could send them a follow-up request.

David ETTERSHANK: Okay, sure. In terms of the modelling you did on the mid-Maribyrnong, I am interested in that around the township there and the Rivervue site, obviously. Would your report basically be pretty much the current one? Are you aware if there has been a major review of your flood modelling since 2003?

Chris FRENCH: I am not aware of there being a major review. That does not mean there has not been one, but no, I am not aware of one.

David ETTERSHANK: Okay. All right. And you had no involvement in Rivervue, other than that you noted that there was a propensity for that site to flood. Am I correct there?

Chris FRENCH: Yes. Our flood model from 2003 of the mid-Maribyrnong did touch on the site that would later be developed with Rivervue, which showed a flood map that included that land, and it showed the flood level across that land in actually much the same alignment as the previous LSIO over that land. That is what our flood modelling showed. So to answer your question, we were not involved in any flood modelling or the LSIO changes or anything like that to do with Rivervue, no.

David ETTERSHANK: Okay. Forgive our persistence here; we have got these sort of very, very different stories, and no-one has been able to do the forensics on it.

Chris FRENCH: And hence my opening statement, in an effort to clarify some of those miscommunications.

David ETTERSHANK: That is appreciated. It was very clear. I have probably just doubled for the purposes of the record. Your expertise, obviously, is broad in this area, and we were just talking previously to the Centre of Excellence for Climate Extremes, and I guess we were exploring the question of climate change and what it means for assumptions around one-in-100-year flood events and how that is then reflected in

building approvals. I am wondering: is this something you would like to offer some thoughts on to the committee in terms of current flood plain LSIOs and the ongoing impact of climate change?

Amanda GILFOYLE: I can touch a little bit on that. The one-in-100-year or 1 per cent AEP, depending on which terminology we are using, is the commonly adopted approach throughout Australia in terms of planning and where people are planning and what they are basing their planning decisions on. The new flood mapping, or flood mapping for a little while, actually – I cannot give you the exact date, but it has been more recent than 2003 – does require through AR&R the consideration of climate change, and that is an ongoing and an updated process. Where we are seeing climate change, and I think where some of the nuances come into this 1 per cent AEP element, is what horizon are we looking at in terms of climate change? Are we looking at it from a 2100 perspective or a 2050 perspective? So there are some conversations there to understand how you are looking at matching a 1 per cent AEP with the planning horizon and what the appropriate parameters to be put around that are. And then thinking about: well, what does that mean, what are the adaptation measures that we need to think about in terms of risk-based planning for what may or may not change, and also what is the sensitivity in the climate change? What is the ultimate response? Is it mitigation? Is it protection? Or is it looking at different adaptation measures? So that is a decision a bit beyond our area of influence but something to consider.

David ETTERSHANK: The beauty of being before a committee is you do not have to have the authority; you can just have the attitude, as I understand it, although I am new to this. In that context can I ask a simple question: I mean, should we be building on flood plains?

Chris FRENCH: Do you want me to have a crack at it?

Amanda GILFOYLE: We can both have a crack. It is an interesting conversation and an interesting question: should we be building on flood plains? It depends on where we are in space. So if we are looking at an urban area – we have got massive population growth in Melbourne – we are getting to the point now that a lot of the undeveloped land has been undeveloped for a reason. It has either been contaminated or it has been historically on a flood plain. So is that something we need to think about in how we develop on these flood plains? We are trying to get more housing and more people into the city. How do we actually think about that in terms of adaptation? It is understanding the risk, understanding what the impacts might be but developing that land in a way that actually can facilitate and accommodate that going forward. Are there some sacrificial lower bottom areas in high-rise? I am not sure. And then you start thinking about a regional or rural context. We can probably look at building away from flood plains in that context. But in an urban setting, maybe that is a way we have to go down to continue to accommodate additional population growth but being considerate of understanding the risks and mitigating and/or adapting. What is the risk-based planning for that? Anything you want to add, Chris?

Chris FRENCH: I do not think I can add much more to that, Amanda. Thanks.

David ETTERSHANK: Obviously that was a good answer then, wasn't it? I think you talked about if it is sacrificial – you used an expression.

Amanda GILFOYLE: I did. It is something I have heard historically looking at some of the responses from Queensland when Indooroopilly flooded, back in 2011 now. Thinking about when they were rebuilding, if you had a high-rise, or an old Queenslander – I am a Queenslander too, by the way –

David ETTERSHANK: Ditto.

Amanda GILFOYLE: which is elevated up, you have got that element of water being able to flow through. Or if that is in a built-in area, we have seen examples with more of a container-style development – that that is something that can be hosed out when the flooding does come through but does not actually impact the people living in a higher storey to that. So that is a possible way that I have seen over time.

David ETTERSHANK: Either way, the current status quo cannot continue as it is, I think. Would that be a fair description?

Amanda GILFOYLE: That is a question for you, the committee.

David ETTERSHANK: When we look at, say, for example, Maribyrnong township, I guess my concern would be that you have got hundreds and hundreds, at least 600 hundred houses there, that went under in the last flood and yet it would seem to me that, if we can make some assumptions about ongoing climate change and the intensity of future rain events and suchlike, we are building brand new Maribyrnongs, aren't we?

Chris FRENCH: That is a very broad comment.

David ETTERSHANK: I have that happen; it is a good way to get a conversation started.

The CHAIR: You should have heard what Mr Pagone said earlier.

Chris FRENCH: That is beyond what we could perhaps answer. Look, there are some societal questions that you are asking there, and perhaps this committee can provide some recommendations to government around those sorts of issues, because they are the sorts of things we need to deal with as we adapt to climate change.

David ETTERSHANK: So it is going to be a live issue, and we should be aware or alive to the real risks of not recognising that impact into he future?

Chris FRENCH: I think we definitely have to plan with climate change in mind – definitely, yes – and all of the different ways that might manifest itself.

David ETTERSHANK: Okay, thank you.

The CHAIR: And we will get to that in our next inquiry.

David ETTERSHANK: Quite possibly, yes. Absolutely.

Samantha RATNAM: I have got a couple more questions if I have some time. We are aware that there was much opposition to the building of the Flemington Racecourse flood wall in the local community, with all three potentially impacted councils, in Maribyrnong, Moonee Ponds and Melbourne, opposing it. Also expressing concern were a number of highly credentialled specialists – water engineering consultancies and other experienced hydraulic modelling practitioners. One of these contacted the US Army Corps of Engineers, the writers of world-famous software that was told to specifically not model with unrealistic data, naming Manning's roughness coefficients, nor calibrate to total energy lines the way GHD had done on that occasion. The written email responses from the US Army corps are now available on the parliamentary website and were tabled at a meeting with Melbourne Water's managing director Professor Bob Keller and GHD back at that time. So despite all these objections to GHD's flood wall hydraulic modelling at that time, including from the writers of that software, why did GHD proceed with that proposal and continue to have confidence in that modelling?

Chris FRENCH: I think there are probably a couple of things to address there. Firstly, the work we did then was peer-reviewed and the subject of significant discussions and debate before it was approved. I think it is appropriate in any sort of scientific field that things get debated and that there are potentially conflicting views and that they are shared and they are worked through. That is certainly what happened in this case, and GHD explains in its reports why it made the decisions that it did in the specifics of each of the types of points you have made and addressed those. Bob Keller addressed several of the ones that I think you are referring to in his peer review of our work, and on the basis of our experience and the peer review and the debate that happened we stand by our work from 2003.

Samantha RATNAM: Many members of the community believe that the flood wall must have had an impact on the flooding, because if you look at the photos, the racecourse is such a large area, yet your modelling showed that it was likely to have very little impact. To help people who are not engineers understand this, is the modelling saying that the volume of water which would have been sitting across the racecourse is small relative to the volume of water passing down the river in a flood? Is that why you all maintain that it would have had little impact or has little impact?

Chris FRENCH: I must confess I am a water engineer but a water treatment engineer, not a flood engineer, so explaining it in a clear way – I might have to take on notice the best way to explain it. I do not know if you feel like you could, Amanda? Otherwise we can take it on notice.

Amanda GILFOYLE: Yes, for the interests of time probably I would take it on notice. It is probably worth just noting, though, it is the flood wall and the mitigations in combination that have the impact or the net zero impact that we were looking for. It is the flood wall itself, I think the report did say, that would actually have an impact. That is why the mitigations were implemented and constructed as required.

Chris FRENCH: And those mitigations were things like widening and creating greater flows of water through for the conveyance of the flood faster than it would otherwise have been, so that is the sort of balancing impact of the mitigation measures versus the wall itself.

Samantha RATNAM: Okay.

Chris FRENCH: In terms of some commentary around volumes of the storage versus the flow, I could not speak to that with any authority.

Samantha RATNAM: But are you happy to take it on notice if somebody was able to provide some information to us?

Chris FRENCH: Yes.

Samantha RATNAM: Thank you very much. Related to that, in terms of mitigation works that can alleviate flood risk and your views on that, with what has happened at Rivervue – and granted that you have spoken about your involvement and then lack of involvement following 2003 – it strikes us that you have got this modelling in 2003, and your modelling itself said there would be flooding impact on that affected area that was subsequently flooded in 2022. Subsequent to your work lots has happened. There have been planning scheme changes applied for. It looks like there have been appeals made in terms of the planning process to say, 'Look, we think we're able to build on this if we do appropriate mitigation works.' And then subsequently planning approvals have been given subject to mitigation work. Somebody signs off on that mitigation work and it gets built, and then lo and behold, you have a flood and it ultimately gets tested by a flood. Who has the responsibility for assessing, one, whether the mitigation works have happened to the standard required that gave its initial approval and assessing whether those kinds of mitigation works are actually effective in being able to alleviate a flood risk? Do you all have any involvement in that work, to assess that mitigation work?

Chris FRENCH: Firstly, we did not have any involvement with that work.

Samantha RATNAM: No, that is right. But more broadly for your expertise.

Chris FRENCH: In terms of who has responsibility, there is a planning process and a rigorous planning process that occurs with developments. I am not familiar with the details of what happened with the Rivervue development and their planning. It is obviously over a long period of time, and I have read some of the elements of the inquiry so I have heard some bits of it. But that is a planning process that is sort of spelt out before the planning permit is granted by the local government.

Samantha RATNAM: So it seems like you can get some assessment about this mitigation work which will mean that you can build a little bit more on this otherwise flood-affected area in the planning process. Then somebody ticks off saying, 'Oh, the mitigation work was done.' But who assesses the quality of that mitigation work and assesses whether this is the mitigation work that is actually going to prevent the flood? Does anyone have responsibility? I am thinking more about your sector-wide experience here, your expertise? Does anyone do that check and balance? Because we are interested in where the checks and balances have fallen down, because something clearly fell down, and how do we make recommendations to improve and fill that gap? Is it a planning officer who goes, 'Oh, that mound was built or that catchment' – whatever was built – and therefore you have done your job? Are they saying it was deep enough and will actually do what is needed?

Chris FRENCH: I am not aware of an agency that has specific responsibility for that. My sort of immediate response would be to think that it would be a condition of the planning permit typically as to how those works would be undertaken and they would be conditions in a planning permit that might spell that out. I am not familiar with the Rivervue development planning permit process or who was involved and that, so I cannot speak to a specific around that. But that would be where I would typically assume that sort of thing to be included.

Samantha RATNAM: So you all are not commissioned then to do the assessment of the adequacy of those mitigation works ever is my question, in the industry more broadly – somebody comes and asks you to do the final tick off, like a surveyor goes and looks at the final building.

Amanda GILFOYLE: I am not aware of ever being asked to check the adequacy of the mitigation works.

Samantha RATNAM: Okay. All right. That is interesting.

Amanda GILFOYLE: But it could come into the wording of a planning condition, whether they are implemented in accordance with or subject to X's approval.

The CHAIR: To the satisfaction of the responsible authority.

Amanda GILFOYLE: Yes.

Samantha RATNAM: The authority. That is right. Just checking that process, because something is falling down there.

Chris FRENCH: That would be my assumption, noting I confess I am a chemical engineer, not a planner.

Samantha RATNAM: No, I understand.

Chris FRENCH: My deep understanding of the planning process is pretty limited.

Samantha RATNAM: Appreciate that. That is right. One final question: Rivervue have told this inquiry that they are returning residents to properties which were flooded without rebuilding them higher or making other changes in the hope that structural mitigation will happen before the next major flood. Do you believe that it is possible or likely that adequate mitigation measures will happen to allow people to continue to live in those properties? Granted you were not involved in that sort of subsequent modelling and that process, but just in terms of your expertise, have you all had a look now at what happened and how that flood behaved based on your 2003 work and then what happened? Have you all had any look at it? Do you have a view on it at all?

Chris FRENCH: We do not have a deep understanding of the Rivervue development and therefore do not have an opinion on what could be done. We have not investigated that, no. We have not been commissioned to or have not off our own bat either.

Samantha RATNAM: You have no involvement in the current work that Melbourne Water is doing to assess the impact of the flood wall that they are going to report in April. Have you got any involvement in that work at all? It is not being commissioned to you. Great, thank you. That is it for questions.

The CHAIR: No worries, thank you. That is all of our questions.

Samantha RATNAM: Just one, sorry –

The CHAIR: See, like almost, right? I was like with that, cut.

Samantha RATNAM: I promise it is not even a question; it is just a point of clarification. I have just got some advice about the question I asked earlier about whether it was possible to provide on notice the list of work that you have been commissioned by Melbourne Water to do. My understanding is that we can make that request of you and then in terms of assessing commercial-in-confidence that is something that the committee can assess at a later stage. But I would like to reinstate that question asking on notice whether we can have a list of the work that Melbourne Water has commissioned you to do?

The CHAIR: As I said, I think a lot of that material is in the public domain.

Chris FRENCH: Look, I will take on notice the question.

The CHAIR: You can have a look at what is in the public domain and point us to that if you think that is an efficient use of our time.

Thank you very much. That is the extent of our questions. We will provide you with a copy of the transcript for review in about a week prior to its publication on our website. At that point we will take a short break.

Witnesses withdrew.