



# Legislative Council Environment and Planning Committee

**Hearing Date:** 11 October 2023

**Question taken on notice**

**Directed to:** Ron Sutherland, Geoff Crapper

**Received Date:** 2 November 2023

## 1. **Samantha Ratnam, page 50-51**

### **Question Asked to Ron Sutherland and Geoff Crapper:**

I will ask on notice what was wrong with the GHD modelling.

### **Response:**

GHD was responsible for the hydraulic modelling of the Maribyrnong River that (i) on behalf of the VRC, justified to Melbourne Water's satisfaction that construction of the Flemington floodwall would not adversely impact on flood levels, and (ii) on behalf of Melbourne Water sometime prior to 2015, substantially lowered the 100 year flood level on the Maribyrnong River by 0.6 m in the vicinity of what is now Rivervue Retirement Village.

### **Flemington Floodwall modelling by GHD**

As originally identified in my 23<sup>rd</sup> July 2003 report while still employed at Melbourne Water, GHD adopted unrealistically low Manning n roughness coefficients in their HEC-RAS hydraulic model to calibrate the 100 year flood levels they were required to model to. Melbourne Water had determined these 100 year flood levels as part of the 1986 Maribyrnong River Flood Mitigation Study hydraulic modelling work.

But simply, the lower the Manning n coefficient used in the modelling the lower the resultant flood level that is generated by the model.

My initial concerns with GHD's modelling, were subsequently supported by independent water engineering consultants in Water Technology and WBM Oceanics, who were engaged by Moonee Ponds City Council to review the soundness of the assumptions and techniques adopted by GHD in their modelling.

I have included an important letter from Water Technology to Melbourne Water, dated 29<sup>th</sup> October 2004, in Appendix D of my submission and below is the conclusion in WBM Oceanic's report to MVCC dated 25<sup>th</sup> February 2004, not included in my submission.

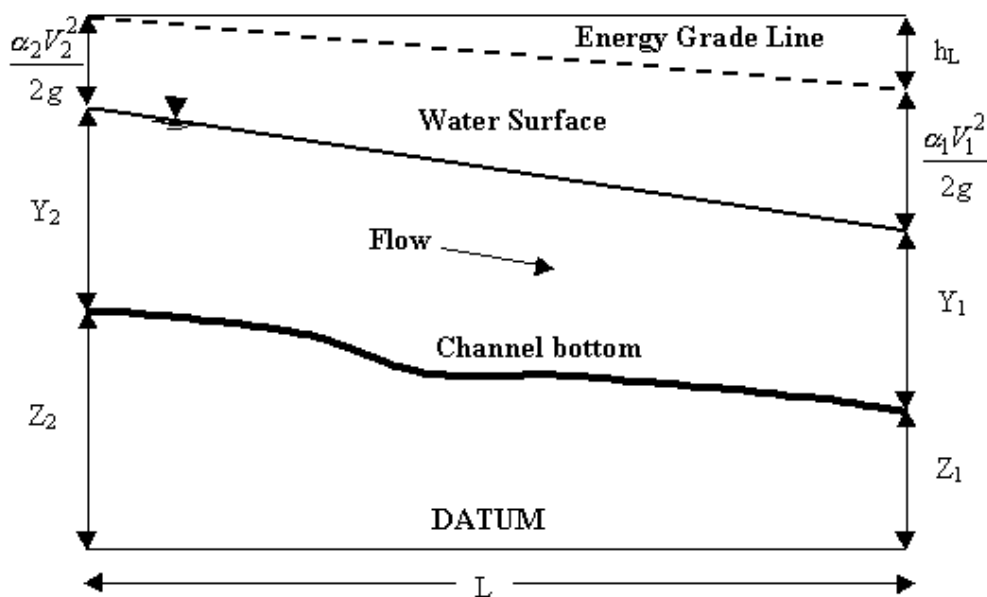
## Conclusion

A number of shortcomings were identified that has led to the conclusion that the impacts presented in the report cannot be considered reliable until these issues are addressed. They are summarised below.

- Sensitivity testing and/or further rigorous analysis is required to demonstrate the significance of the assumed stage-storage relationship.
- Flood level impacts downstream of Lynchs Bridge may need to be reviewed subject to the outcomes of the above sensitivity test.
- The assessment of impacts in the Fisher Road to Lynchs Bridge reach may be underestimated because of the location of the downstream boundary and the assumed water level at the boundary. The report should also provide comment on the affect of adopting a steady state model on flood level impacts.
- The reduction in the expansion loss coefficient at the Footscray Bridge may be too large given that the training wall is not being constructed at both abutments.
- The afflux should be presented as change in water level as well as change in TEL for all cases assessed.

A complicated methodology combining HEC-RAS, FLS and RORB was required to assess the impacts of the proposed floodwalls because neither HEC-RAS nor FLS could adequately model the system in its entirety for the purposes of this study. Hydraulic modelling software is available (and has been for some years) that could model the system within one package by utilising dynamic links between one-dimensional and two-dimensional domains. The use of such software would have eliminated the first three concerns raised above.

Ron and I understand GHD was advised by their consultant Dr Bob Keller that it was somehow acceptable to model Melbourne Water's 100 year flood levels to the total energy line (TEL) along the river instead of the water surface profile (WSP) which the 100 year flood levels represented. The diagram below from "Introduction to HEC-RAS" demonstrated how the TEL or Energy Grade Line is meant to be defined.



<https://www.caee.utexas.edu/prof/maidment/grad/tate/research/rasexercise/webfiles/hecras.html>

This resulted in GHD's modelled 100 year flood levels for the Maribyrnong River being in the order of 0.3 metres (300 mm) too low

Modelling to the TEL is contrary to all acceptable hydraulic modelling principles, and most importantly by the U.S. Army Corps of Engineers who are the owner and proprietor of the HEC-RAS hydraulic model used by GHD for their modelling of the Maribyrnong River.

In late 2004, after closely reviewing GHD's HEC-RAS modelling, Ron took the initiative of contacting the HEC-RAS Team at the U.S. Army Corps of Engineers to ask them specific questions on GHD's use of the HEC-RAS model in relation to the hydraulic modelling for the Flemington floodwall.

A copy of the complete unedited email exchange between Ron and the U.S. Army Corps of Engineers HEC-RAS Team is contained in Appendix D of my submission.

The essential part of the advice from the U.S. Army Corps of Engineers was that Manning "n" values used by GHD, **"are NOT realistic"** and recommend their lowest Manning "n" value be doubled.

They went on to say ***"Do not model with unrealistic data (n values) to match high water mark" (Total Energy Line) "match the WSP" (water surface profile).***

You can't get any higher condemnation of GHD's hydraulic modelling for the Flemington floodwall than from US Army Corps themselves.

In Melbourne Water's 31<sup>st</sup> May 2005 media release titled ***"Melbourne Water Confirms Maribyrnong Advice"***, which finally signed off on their decision to allow the Flemington floodwall to proceed, they make the extraordinary statement ***that "Melbourne Water has not been privileged to see any comment that the authors of the software (USACE) have made"***.

This is totally contrary to my and Ron's recollection of what happened with the damning comments by the USACE, which Ron recalls tabling at the meeting convened by Melbourne Water, which he presented to both Dr Bob Keller and Melbourne Water Managing Director Rob Skinner.

### **Conclusion (i)**

The 14-Oct-2022 flood on the Maribyrnong River provided an excellent opportunity for Melbourne Water to rigorously determine any flooding impacts from the Flemington floodwall by obtaining a comprehensive record of flood levels along the Maribyrnong River downstream of Maribyrnong Township to Fisher Parade Bridge (the start of the Flemington floodwall) along the 3 kilometre distance of river to Lynches Bridge (Smithfield Road/Ballarat Road), Angliss Stock Bridge, Kensington Railway Bridge/Norther Railway Culverts. Hopetoun Bridge (Dynton Road) and Shepherds Bridge (Footscray Road).

But instead, Melbourne Water's Maribyrnong River flood level survey data, dated 9-Mar-2023, only contained one single flood level recorded on the Maribyrnong River downstream of Maribyrnong Township at Kensington of 1.19 metres AHD), on page 6 of the survey data, which was 0.42 metres higher than an anomalously low "floor level" of 0.77 m AHD.

[https://hdp-au-prod-app-mw-yoursay-files.s3.ap-southeast-2.amazonaws.com/4016/7841/2990/Maribyrnong-River\\_flood-level-survey-data\\_Oct22.pdf](https://hdp-au-prod-app-mw-yoursay-files.s3.ap-southeast-2.amazonaws.com/4016/7841/2990/Maribyrnong-River_flood-level-survey-data_Oct22.pdf)

I say anomalously low because a floor level of 0.77 m AHD is so low it would be inundated several times each year by an extra high tide in Port Phillip Bay.

So yet again, Melbourne Water has demonstrated they are unfit to discharge their duties as the Responsible Drainage Authority for Greater Melbourne if the best they can do is produce one single flood level on the Maribyrnong River downstream of Maribyrnong Township to critically review the impacts on flood levels caused by construction of the Flemington floodwall.

### **Rivervue Retirement Village modelling by GHD**

There is nothing much more I need to say to discredit GHD's hydraulic modelling and 100 year flood levels for the Maribyrnong River at Rivervue Retirement Village.

As if it wasn't bad enough for 47 villas at Rivervue to be flooded up to 0.3 metres (300 mm) deep on 14-Oct-2022 by what Melbourne Water acknowledges was only about a 50 year flood, my now widely reported revelation that GHD's 100 year flood level of 6.0 m AHD at Rivervue was 0.07 metres lower than MMBW's recorded May 1974 flood level of 6.07 m AHD (by about a 40 to 50 year flood) has been enough to lay any doubts to rest.

The question remains, how could have GHD's hydraulic modelling for the Maribyrnong River at Rivervue been so dramatically wrong?

### **Conclusion (ii)**

The only conclusion I can come up with is GHD must have made the same flawed assumptions they used in the Flemington floodwall modelling, namely unrealistic low Manning n roughness coefficient in the Maribyrnong upstream of Canning Street that was compounded by using the total energy line to define the 100 year flood level line, instead of the water surface line.

Given that several of the flooded villas at Rivervue have been built on between one and two metres of filled material it casts grave doubts about how one of Melbourne Water's key flood conditions concerning earthworks, in the original retirement village planning permit back in June 2006, could have ever been properly met by the developer and signed off by both Melbourne Water and Moonee Vallee City Council, namely 39 (b) which states,

***“Any earthworks must be done such that the volume of cutting within the floodplain is equivalent or greater than the volume of filling. Before starting works, volume calculations must be submitted to Melbourne Water demonstrating that the volume of filling does not exceed the volume of cutting.”***

Again, given the detailed topographic survey plan produced by the developers in 2007 it is totally inconceivable the 47 low-level villas could have ever been built while complying with Melbourne Water's Flooding Condition – Earthworks 39 (b).

It follows that the significant filling of the floodplain that has undeniably occurred upstream of Canning Street, as part of the retirement village development, has potentially exacerbated the flooding at Rivervue and caused flood levels higher than they could have been expected to be with the 50 year flood on 14-Oct-2022.

Unlike downstream of Maribyrnong Township where there is insufficient flood level data to carry out a proper investigation into GHD's hydraulic modelling for the Flemington floodwall, at Rivervue there is an abundance of flood level data from 14-Oct-2022 which could be used to accurately assess the Manning n roughness coefficient upstream of Canning Street, which could in turn be used in conjunction with the 2007 topographic survey plan to work out whether the significant filling of the floodplain did exacerbate flood levels at Rivervue.