UHCC - PC42 Hearing

Pinehaven Stream – Flood Mapping Audit 2015

Save Our Hills (Upper Hutt) Inc.

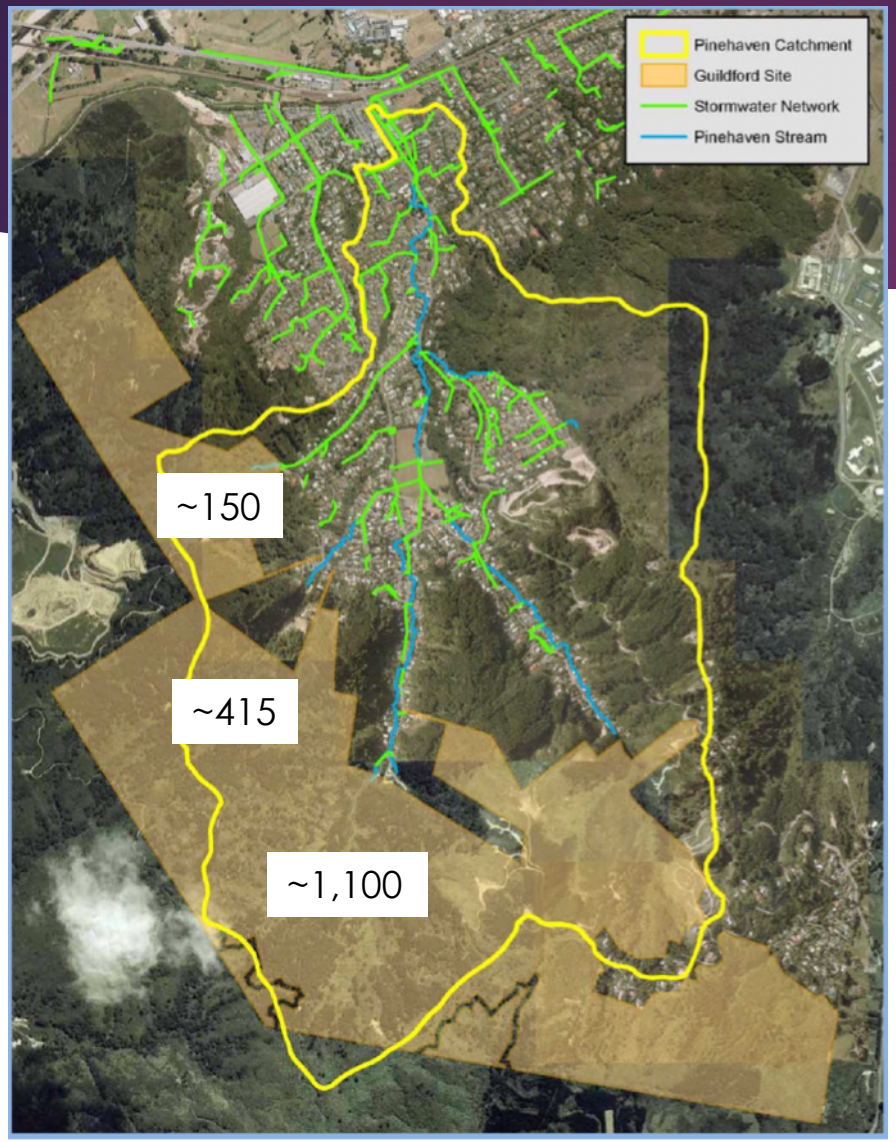
Despite claims of several audits, there has only been one independent audit to date of the Pinehaven Stream Flood Maps:

- The only external audit of the flood model & mapping was carried out by Michael Law (Beca) – see "Report: Pinehaven Stream – Flood Mapping Audit, 13 July 2015"

Other reviews were NOT external audits of the flood mapping:

- A *"review of the hydrology was completed by a GWRC hydrologist"* GWRC Report 14.597 to HVFMS, 20 Nov. 2014 p2, A. Allan
- DHI (developers of the MikeFlood modelling software) reviewed the way SKM (now Jacobs) had set up the software; it was NOT a review of the flood model and mapping (see Pinehaven Flood Hazard Investigation Report Vol.1, 2010, p20 s4.3, & Appendix

GWRC/SKM test hypothetical 'future development' scenario



- Figure 8 Guildford Land

Figure 8: Guildford Timber Company (GTC) Land

Yellow outline indicates the Pinehaven Stream catchment area

Brown overlay is the Guildford block

Assumed Future Development Scenario

150 + 415 = 565 houses (approx.) on ridges in catchment above Wyndham Rd & Jocelyn Cres

1,100 houses (approx.) on ridges in catchment above Pinehaven Road

Q: What would be the impact of this high level of GTC development on flooding in Pinehaven?

Pinehaven Stream Flood Hazard Assessment: Flood Hazard Investigation Report, May 2010 Rev E, Vol 1, pp13-14 & Fig. 8 Future case scenario - development on about half of Guildford land

GWRC/SKM test hypothetical 'future development' scenario

Figure 19: Comparison – Existing vs Future

Blue indicates existing situation - predicted flooding with no housing on the ridges

Green indicates additional flooding from 1,665 future houses on Guildford land

Conclusion - quoting from GWRC report:

"The model results show that there is potential for future development to increase flooding in the catchment … However, the change in extents are minor … less than 100mm increase in inundation depths across the catchment."

A: Minor … less than 100mm increase in flooding.

SOH strongly challenged this conclusion!

Pinehaven Stream Flood Hazard Assessment: Flood Hazard Investigation Report, May 2010 Rev E, Vol 1 Fig. 19, p30 "Current Existing vs Future Case Comparison of Predicted Flooding Extents in the Q100 with Climate Change"

2014 - Petition for Audit

- GWRC held public consultation on Pinehaven flood maps from 16 October to 14 November, 2014
- 260 local residents signed a petition for a full independent, transparent audit of the Pinehaven flood maps
- All consultation submissions were 'frozen' by GWRC
- A special meeting was scheduled for 23 January 2015 with representatives from Pinehaven community to finalise Terms of Reference for the proposed external audit

5 attempts to focus the audit Terms of Reference on the critical issue were ignored by HVFMS

1. 20 November, 2014 – Several residents [Keith Thomas, Desire Sinclair, Melanie Brown (also for Darryl Longstaffe), Stephen Pattinson, Sue Pattinson, Geoff Workman, Bob McLellan and Stephen Pattinson for Co-Design Architects] addressed GWRC's Hutt Valley Flood Management Sub-committee (HVFMS) requesting the audit focus on the right issues, especially the 'future development scenario' (see Attachments 5.A1, 5.A2)

2. 14 January, 2015 – SOH wrote to GWRC's HVFMS advising clearly in specific detail what SOH and the community wqnt the audit to address (see Attachments 5.A3, 5.A4)

3. 23 January, 2015 – SOH attended TOR meeting; we were not permitted to table our four Case Studies to explain the apparent discrepancies in the flood maps we want audited

4. 23 January, 2015 – SOH letter to HVFMS advising the TOR do not address community concerns about future development discrepancies in the maps(see Attachment 5.A5)

5. 24 February, 2015 – SOH attend HVFMS meeting, specifically advising HVFMS that the audit needs to investigate the claim that large-scale future development on hills will have only 'minor' impact on flooding across the catchment (see Attachment 5.A6)

2015 Audit finds SOH's concerns valid

Table 4.3 – Model review rating scheme Beca Audit Report 2015, Pages 5 & 9

Description	Audit rating	Fit for use
No issue: The element or parameter being reviewed is represented acceptably	0	Yes
Minor issue: There is an issue, but it is unlikely to significantly affect use of the maps	1	
Major issue: Failure to resolve the issue compromises the maps and should be rectified, but may be resolved by explanation or acceptance of map limitations.	2	?
Fatal flaw: Failure to resolve this issue severely compromises the understanding and interpretation of the maps, and should be rectified before the maps are accepted.	3	No
Future development	2	No

The upper parts of the Pinehaven catchment are bush and forestry. Sub-division development has been mooted for these areas and it could be expected that there would be some infill development in the lower parts of the catchment. While not pre-judging the outcome of any application to develop within the catchment, it is prudent to assess the effects of possible future development when undertaking flood mapping and hazards studies.

To that end, SKM ran the model with reworked hydrographs to represent the additional impervious area associated with the development of 1665 lots of 750 m^2 in the upper parts of the catchment. This is probably an over-estimate of the number of lots that could be developed, and as such represents an upper bound on the effect of development on catchment flows and flood extents.

Given that the upper catchment is steep, natural runoff could be expected to be quite high and so the relative effect of development would not be great. Were development to occur, mitigation measures would almost certainly be required to attenuate flows and at least reduce peak flows to existing conditions.

As noted in Section 8 below, including future development increases modelled peak flows by 18% in sub-catchment B and 13% in sub-catchment E. However, there is no post-development increase in flood volumes. This is unexpected given the increase in impermeable area. MWH were unable to provide an explanation for the lack of increase in flood volume, and so the future development runs of SKM's flood model are potentially compromised in this regard.

"SOH's concerns are upheld that the effects of future development on flood extent are not modelled correctly."

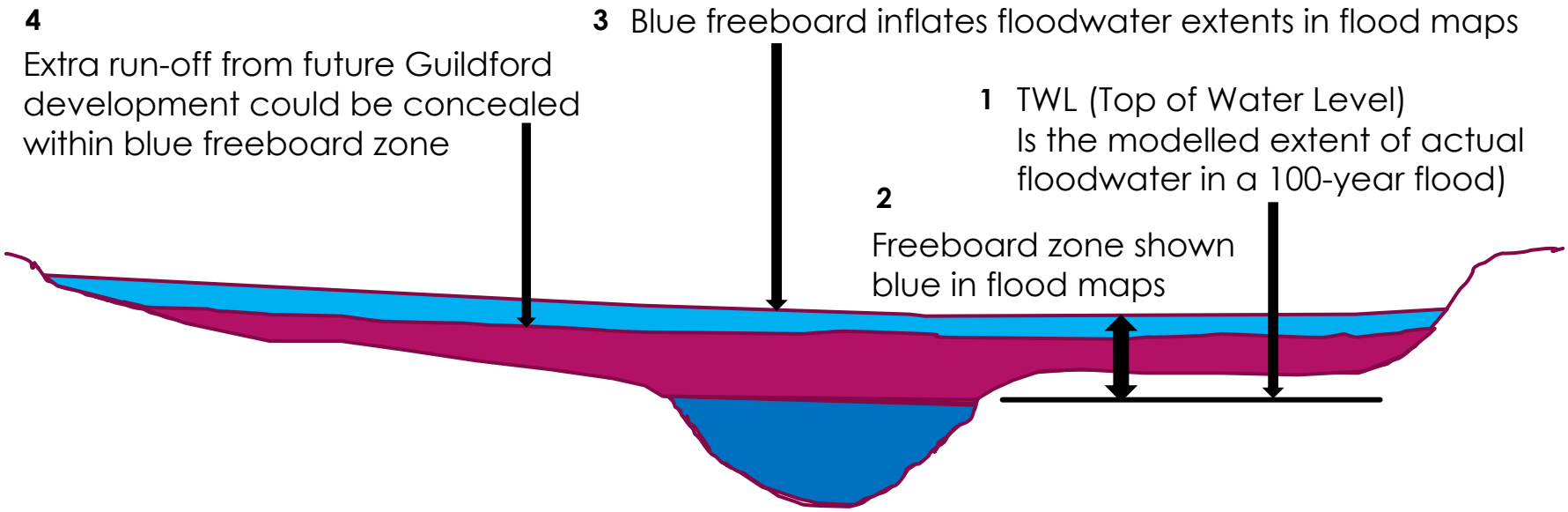
Beca Audit 2015, p17

The flood maps are not fit for detecting run-off from future development on the hills!

Unsatisfactorily, the 2015 audit suggests… extra run-off from future development can go in the blue freeboard zone without materially affecting the flood maps

"the effects of future development on flood extent are not modelled correctly. However… because there is freeboard incorporated into the results, the flood maps are unlikely to be materially affected by this apparent anomaly."

Michael Law, Auditor, Beca Report, 13 July 2015, p17



Is this why HVFMS (GWRC, HCC and UHCC) and their experts and consultants have insisted all along that freeboard must be modelled as floodwater, to accommodate future run-off from the Guildford development?

The Auditor's tale … and the tampered data to tell it!

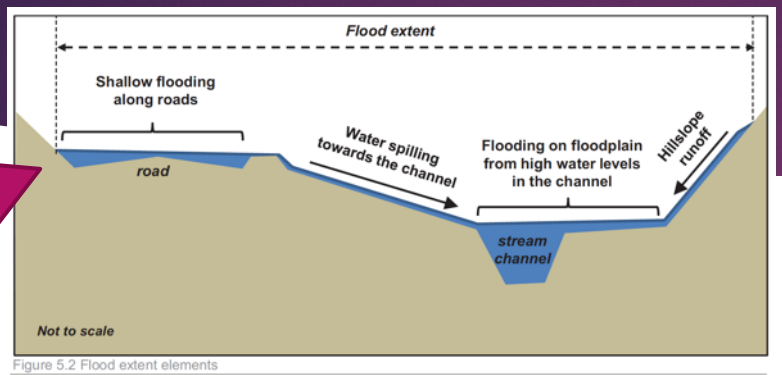
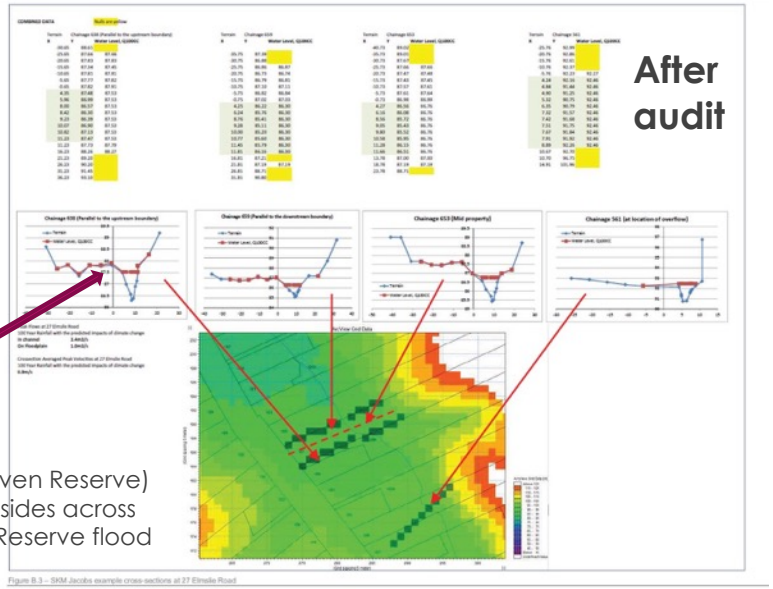


Figure 5.2 Flood extent elements

Similar situations to that at Elmslie Road occur at the other three locations identified by SOH's case studies.

The auditor's tale about 27 Elmslie Road [and 3 other cases*] (shown in the auditor's diagram above)

Before audit



After audit

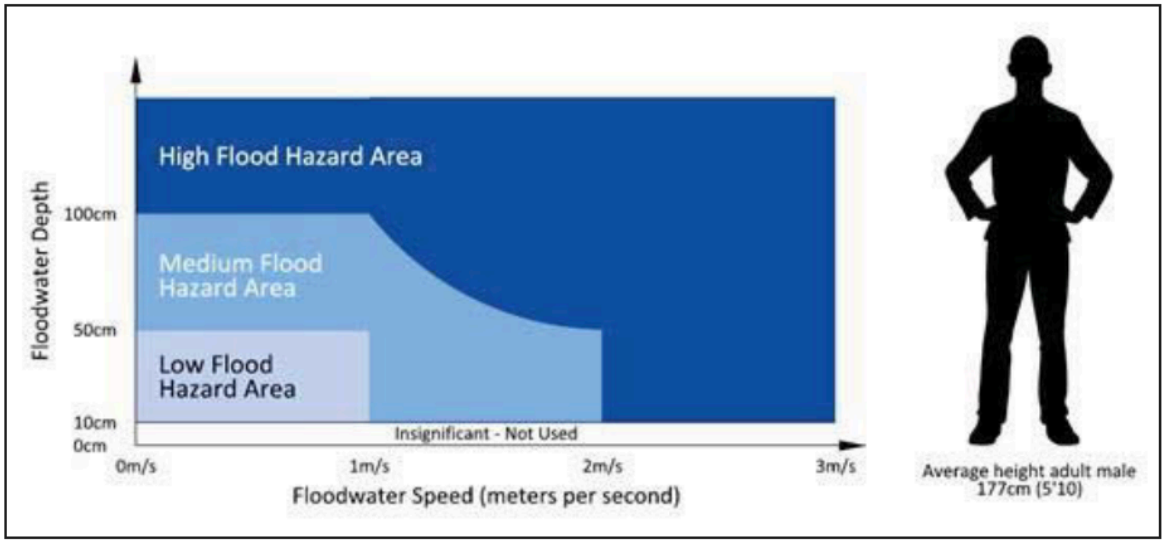
Tampered data:

1. There is no flooding on Elmslie Rd at No. 27 (see GWRC flood map for 27 Elmslie Rd on PC42 Hearing Slide 3.22]
2. Before audit …. Water on berm is separate from water in channel (data on GWRC graphs, top right of slide).
3. After audit …. Higher ground removed from berm and berm water shown flowing into channel (altered data, graphs bottom right) to fit the tale in the diagram above.

*Two of the other case studies are NOT like the one above (Dunns St and Pinehaven Reserve) – they're flat. The tale in the above diagram (of water flowing from adjacent hillsides across the property and into the stream) doesn't explain why Dunns St and Pinehaven Reserve flood extents are so wide (and deep) - PC42 Hearing Slides 4.4 & 4.6

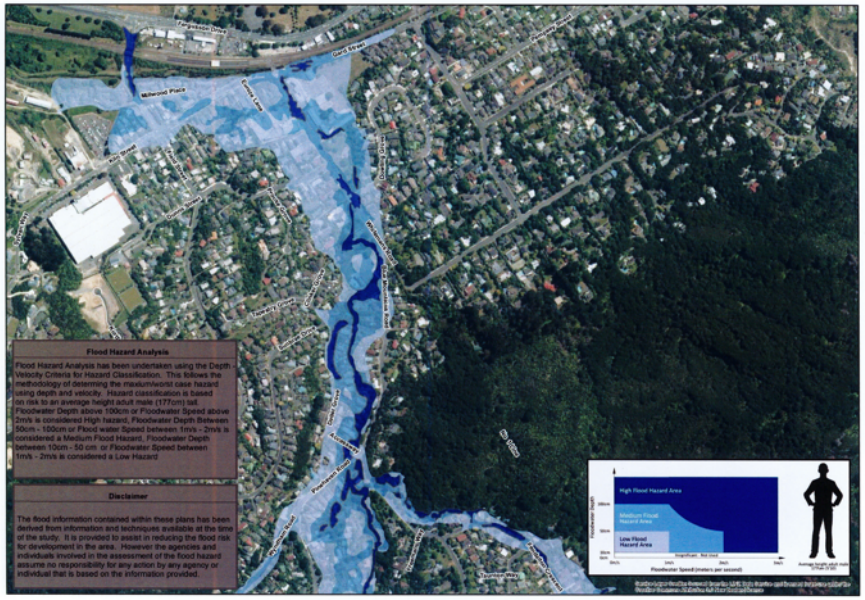
How to create clearer and more informative flood hazard maps

For example, describing the area covered by freeboard beyond the modelled flood extent as a Flood Sensitive Area may be more transparent and more appropriate than GWRC's use of all-encompassing Flood Hazard Areas. Changing the name would allow GWRC to provide true flood hazard maps, based on the combination of water depth and flow velocity at any location. These flood hazard maps can be particularly informative in areas where flood extents are large, but there is also deep or fast flowing water in defined flow paths or depressions. Figure 6.4 shows how flood hazard is defined in Hamilton, while Figure 6.5 shows an example of a flood hazard map from the UK based on similar principles.

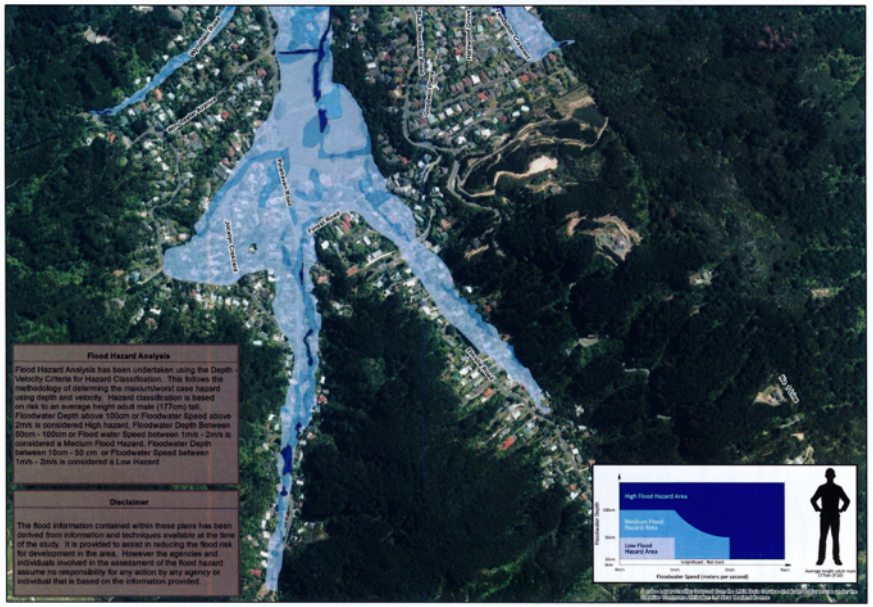


Beca Audit Report 2015, Page 23

Depth x Velocity



65 | P a g e



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GWRC Pinehaven Floodplain Management Plan, Revision 5, 19 February 2016, pp 65-66 Appendix E, Flood Hazard Maps (D X V) = H

"Flood hazard maps often show the flood hazard calculated as a product of the flood depth and water velocity. This is useful from a hazard assessment perspective to understand potential danger to people, and can be readily calculated from the outputs of 2D hydraulic models. … such a map would not show any hazard in the buffer zone between the modelled flood extent and the extent including freeboard."

Beca Audit Report 2015, Page 13

Solution to flawed maps (opp.)

The flood maps opposite, although using the NSW method, are flawed (Slides 5.6 and 5.7). Assuming the outputs of the flood model are correct (check), rectify the "major issue" by:

- removing blue shading of freeboard
- removing actual water depth <10cm

Resulting flood extent will be less and represent the 'current situation' for comparing hydraulic neutrality of future developments (check).