Wellington Water

MEMO

TO	Stephen Davis
COPIED TO	Hamish Wesney
FROM	Alistair Osborne (Wellington Water Ltd)
DATE	05/05/2023
ACTION:	**SUPPLEMENTAL INFORMATION**

Responses to Hearing Panel Questions and submitters evidence

Background

Over the course of the current PC56 hearing questions have been raised regarding the Wellington Water Flood Hazard Mapping by the Hearing Panel along with additional evidence from submitters. The following memo provides responses to these questions and additional evidence.

Model Status

During the current PC56 Hearing I was asked to clarify the status of the flood models still outstanding for Hutt City Council (HCC). Below is information summarising the outstanding models, including a table showing the stages still to be completed and a map of all the HCC model extents.

Hydraulic models for the Eastern Bays and the western hills from Tirohanga north are still in development. No flood hazard layers have been developed for these catchments yet. The modelling for both these areas is expected to be completed by July 2023.

Modelling for South Wainuiomata was begun in March 2023 and will be combined with the modelling for Black Creek (Wainuiomata) to develop a full Wainuiomata model. It is expected that this will be finalised by June 2024. This will complete the stormwater modelling for Hutt City Council stormwater catchments.

Table 1 provides the target completion dates of the various progress stages for the three models noted above. Figure 1 shows the spatial extents of the areas that have been modelled along with catchments still to be modelled.

Table 1: Project stages for outstanding HCC flood models

Model	Model Build	Validation	Community Engagement	Peer review	Flood Hazard Mapping
Eastern Bays	Complete	April 2023	Complete	May 2023	July 2023
Western Hills	Complete	April 2023	May 2023	June 2023	July 2023
South Wainuiomata	December 2023	April 2024	April 2024	June 2024	July 2024

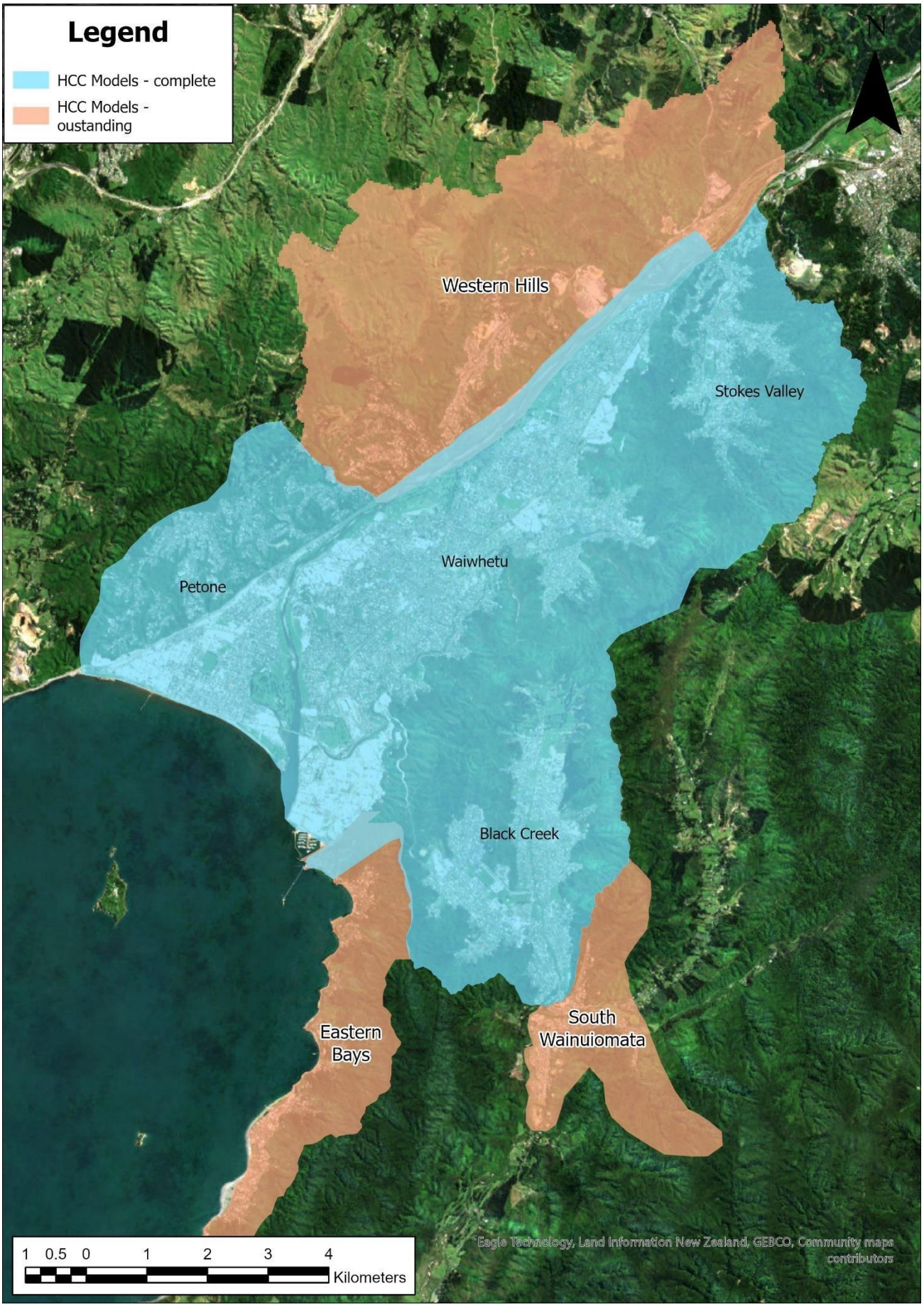

Figure 1: HCC Model extents

Submission regarding the language used for flooding and provisions for access associated with flooding

Elliot Thornton's supplementary statement on behalf of Cuttriss Consultants Ltd, dated 18 April 2023 (paragraphs 16 – 30) submitted on the language used for flooding and provisions for access associated with flooding. He notes that it is important that language used to describe environmental attributes such as flood risk can be readily understood by the community and decision makers to help facilitate informed decisions about potential risks.

Regarding the use of the term 'AEP' rather than 'ARI' in relation to the flood modelling, my position has not changed from my submitted evidence. I do not believe it has material impact on the management of flood hazard. As mentioned in my evidence dated 3rd March 2023, ARI is applied by other councils across the Wellington region for flood hazard mapping.

I do note that my submitted evidence was incorrect in stating that the use of the term ARI aligns with how the current Level of Service targets have been specified. While ARI terminology is regularly used in casual conversations at Wellington Water, a review of the Wellington Water Regional Standard for Water Services (December 2021, Version 3.0) shows that AEP has been used when specifying Level of Service targets.

Regarding provision of a consent trigger for site access during flooding, I believe this is ultimately a planning decision, rather than a technical one. If HCC were to pursue such a trigger, Wellington Water would be able to provide technical support in assessing appropriate depth and velocity thresholds alongside other hazard considerations as required.

Submission regarding the annual exceedance probabilities applied in the Wellington Water flood models

A question has been raised asking whether the annual exceedance probabilities (AEPs) applied in Wellington Water are based on the present day or a future time? And, if a future time, when?

The flood hazard mapping that has been included in the district plan is based on the 100-year ARI (1% AEP) design event including allowance for climate change to the 2130 date horizon. I therefore consider our applied ARI/AEP is for a future time (2130) as the design rainfall applied in the modelling has been adjusted to allow for climate change in the future. I note that my initial evidence incorrectly noted the future date for which climate change has been considered was 2120 (rather than 2130).

Submission regarding the effects of increased rainfall and storm events from climate change

Tony Smith expressed concern about the effects of increased rainfall and storm events from climate change. In particular, he referred to an article[1] by James Renwick at Victoria University discussing the link between climate change and the extreme weather experienced in New Zealand over the summer of 2022-2023 and including comments on a rapid study of Cyclone Gabrielle[2]. The Hearing Panel has asked the following questions:

- Do the findings from the post Cyclone Gabrielle rapid study on rainfall have any implications for the Lower Hutt flood modelling and mapping? Specifically, are the rainfall inputs used still appropriate?

[1] https://www.wgtn.ac.nz/news/2023/03/floods-cyclones-thunderstorms-is-climate-change-to-blame-for-new-zealands-summer-of-extreme-weather

[2] https://spiral.imperial.ac.uk/bitstream/10044/1/102624/10/Scientific%20report%20New%20Zealand%20Floods.pdf

- Do the findings of this assessment, specifically the rainfall inputs, change the level of protection for the existing flood protection structures in Lower Hutt (will the level of service/protection change)?

Regarding the first question, I do not believe the article, or the rapid study post Cyclone Gabrielle have implications for the current Lower Hutt stormwater flood modelling and mapping, and I consider the current rainfall inputs appropriate. The article includes a statement that the findings of the rapid study indicated that "*extreme downpours now drop 30 percent more rain*". The article does not provide a reference point/date from which there has been a 30% increase but based comments elsewhere in the text it may be an increase since the late 1800s.

If this is the case, then the rainfall inputs do already include allowance for that increase. The rainfall applied in the Lower Hutt flood modelling undertaken by Wellington Water have been sourced from the NIWA High Intensity Rainfall Design System (HIRDS) version 4. The design rainfall information provided in HIRDS has been developed from available rainfall records across New Zealand, the majority of which will have been initiated well after the late 1800s. This means any trends of increasing rainfall since the late 1800s will have been picked up and accounted for in the calculations carried out in the development of HIRDS. Furthermore, the 30% increase in rainfall is to the current time, whereas the climate change allowances applied in the Lower Hutt flood modelling is for an increase from the current time to a future date (2130). Finally, it is worth noting that the design rainfall data provided by HIRDS has been developed for these types of applications (hydrological and hydraulic modelling) and is an industry standard source for design rainfall across New Zealand.

Regarding the second question, I presume the submitter is referring to the rapid study on Cyclone Gabrielle (not the Wellington Water flood modelling). Decisions regarding changes to level protection sit outside of my area of expertise. These matters would generally be managed by Greater Wellington Regional Council and Hutt City Council. If the Panel is referring to the flood stopbanks associated with Te Awa Kairangi (the Hutt River) and Waiwhetu Stream, these are managed by Greater Wellington Regional Council.

Query regarding how climate change has been taken into account in the flood modelling

A query has been raised regarding how climate change has been taken into account in the flood modelling. Climate change is accounted for in the Wellington Water flood modelling by making adjustments to the two major boundary conditions in the models; Rainfall and Sea level.

Climate change is predicted to increase rainfall across the Wellington region. To account for this increase, the design rainfall depths applied in the models have been scaled up by 20% to represent a predicted increase by the year 2130. The 20% increase in rainfall has been selected based on an assessment of predicted temperature increases to 2130 in study completed by NIWA for Greater Wellington Regional Council in 2017 (titled *Climate change variability – Wellington Region*).

Note, this is different to the way climate change is accounted for in the current version of HIRDS, version 4, which uses Representative Concentration Pathways (RCPs). This is because the Wellington Water methodology was developed prior to HIRDS version4. Anecdotal checks have found that the 20% increase in rainfall is roughly equivalent to the projected rainfall increase along RCP 6.0 for the period 2081-2100 in HIRDS version 4.

Regarding sea level, climate change is predicted to cause an increase in sea level in the Wellington region. To account for this Wellington Water applies a 1m increase to the sea level boundary used in the stormwater flood models. This is based on the *Climate change variability – Wellington Region* study in 2017, which predicted a 0.71m increase by 2100. This was then extrapolated to 1m by 2130.

The main impact of a high sea level applied in the Wellington Water flood models is a reduction in the ability of the stormwater network and open channels to carry away runoff during rainfall events. This can result in increased ponding depths and durations. One other mechanism of flooding in the models that can result from

the raised sea level in coastal inundation. This has been found to be an issue in Seaview along the lower reaches of the Waiwhetu Stream.