

MARIBYRNONG RIVER

FLOOD EVENT

INDEPENDENT REVIEW

ADDENDUM

October 2023

The Hon GT Pagone AM KC
Chair

Mr Mark Babister RPEV
Director
WMAwater Pty Ltd
Panel Member

Professor Holger
Maier
Director
Systems
Cooperative
Limited
Panel Member

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MVPELA
Director
Planning, Ethos
Urban
Panel Member

Panel Administrator: Ms Wendy Dark

PANEL RESPONSE TO QUESTIONS FOR CLARIFICATION

INTRODUCTION

1. The Independent Review Panel reported to Melbourne Water on 25 August 2023. The Terms of Reference provided for an opportunity for Melbourne Water to send questions to the Panel Chair for clarification regarding the Panel's report. The Terms of Reference also provided for an oral briefing to be provided by the Review Panel.
2. On 10 October 2023 the Panel met with Melbourne Water to provide an oral briefing based upon the questions received from Melbourne Water for clarification. The questions were contained in a letter dated 14 September 2023 from Dr Nerina De Lorenzo to the Chair with an annexure identifying four questions for clarification; two emails from the Review Co-ordinator to the Panel Administrator dated 5 and 6 October respectively; and a document marked 'Panel Report – Review Attachments for Public Release' for discussion with the Panel. The email dated 6 October 2023 from the Review Co-ordinator added two questions to the four which had been asked in the annexure accompanying the letter from Dr De Lorenzo dated 14 September 2023.
3. It may be convenient to deal with the general procedural queries globally before dealing with the technical questions which we have been asked. It may also be convenient to deal with the questions concerning confidentiality in a composite way referring to specifics where necessary for exposition or clarification.
4. A general issue raised for the Panel's direction was about whether some of the information had been provided to the Panel on a confidential basis that might prevent Melbourne Water to disclose it publicly. In that context Melbourne Water has asked for direction on a number of issues concerned with any

confidential basis upon which material had been supplied to the Panel. The document marked 'Panel Report – Review of Attachments for Public Release', for example, seeks direction concerning the appropriateness for Melbourne Water to release publicly some of the information which was obtained.

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[REDACTED] Our response also covers such other

matters as the possible release of transcripts and whether they, or anything else, needs to be redacted. The transcripts were recordings of consultations which had taken place in public but whether Melbourne Water, as a statutory authority, should make them available publicly, or whether it needs to make any redactions, is matter which Melbourne Water will need to consider in light of its obligations and statutory constraints.

8. [REDACTED]
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9. As mentioned above, Melbourne Water asked six questions of clarification about the report itself in addition to the procedural questions to which responses were provided above. Details of these questions and our responses are given below.

10. The first question for clarification relates to the omission of some of the flood warnings that were issued by Melbourne Water from Table 2. The content of Table 2 was based on several sources, primarily provided by the Bureau of Meteorology, but in response to the additional information provided by

Melbourne Water, the following changes and additions should be made to Table 2:

- Major Flood Warning 4 issued by Melbourne Water to the Bureau of Meteorology (BoM) at 8:12 p.m. on 13 October 2022 should be added.
- The table entry about the Keilor gauge exceeding the minor flood level late on 13 October should be immediately after the 13 October 8:24 p.m. flood warning.
- Major flood warning 6 at 2:51 a.m. on 14 October should be added.
- Major flood warning 7 at 8:05 a.m. on 14 October should be added.
- Major flood warning 8 at 2:12 p.m. on 14 October should be added.
- Major flood warning 9 at 7:49 p.m. on 14 October should be added.
- Major flood warning 10 at 11:54 p.m. on 14 October should be added.
- Major flood warning 11 at 11:42 a.m. on 15 October should be added.

An updated version of this table is provided. Along with the addition of the above entries, some additional information is provided about the contents of warnings provided.

Date and time	Agency/Data source	Action or warning type	Comment
Prior to 11 October at 12:11 p.m.	Melbourne Water	Consulting with Bureau	Melbourne Water consulted with Bureau about the need for an initial flood watch to be issued.
After 11 October at 12:11 p.m.	Melbourne Water	Increased forecasting modelling and daily flood watch updates	Increased flood forecasting, modelling and flood outlook scenario development.
11 October at 12:11 p.m.	Bureau of Meteorology	Flood Watch	Includes wording that minor to moderate flooding is expected across the flood watch areas, and that major flooding is likely in some catchments. Maribyrnong River is specifically listed as likely to be affected.
11 October at 4:57 p.m. to 13 October at 4:37 p.m.	Bureau of Meteorology	Severe weather warning for heavy rainfall	Issued for districts including Maribyrnong River catchment. Warning included wording that heavy rainfall may lead to flash flooding.
12 October at 12:03 p.m.	Bureau of Meteorology	Flood Watch	Includes wording that minor to moderate flooding is expected across the flood watch areas, and that major

Date and time	Agency/Data source	Action or warning type	Comment
			flooding is likely in some catchments. Maribyrnong River is specifically listed as likely to be affected.
13 October at 8:15 a.m.	Melbourne Water	Flood warning to Bureau	Issued the first Major Flood Warning (1) for Maribyrnong catchment to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was expected to peak around the Major Flood Level.
13 October at 8:24 a.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River.
From 13 October at 8:24 a.m. to end of event	Melbourne Water	Provision of 6-hourly updates to the Bureau	Melbourne Water continued to monitor and regularly update modelling and forecasting over course of event.
13 October at 12:50 p.m. 14 October at 1:47 p.m.	Bureau of Meteorology	Flood Watch	Includes wording that minor to major flooding occurring or expected across several Victorian catchments. Major flood warning current for Maribyrnong River.
13 October at 2:24 p.m.	Melbourne Water	Moderate Flood warning for Lower Maribyrnong to the Bureau	Issued Major Flood Warning (2) for Maribyrnong River to Bureau, based on revised forecast rainfall data. It stated: <ul style="list-style-type: none"> The upper catchment was exceeding the Moderate Flood Level and rising; and The lower catchment was expected to peak at the Moderate Flood Level.
13 October at 3:24 p.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River expected to peak around Moderate Flood Level on morning of 14 October.
13 October at 3:42 p.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River expected to peak around Moderate Flood Level on morning of 14 October.
13 October at 8:12 p.m.	Melbourne Water	flood warning to the Bureau	Issued Major Flood Warning (4) to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was exceeding the Major Flood Level and rising; and The lower catchment was expected to peak at the Moderate Flood Level.

Date and time	Agency/Data source	Action or warning type	Comment
13 October at 8:24 p.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River expected to peak around Moderate Flood Level on morning of 14 October.
13 October between 11:00 p.m. and 11:59 p.m.	Keilor gauge	Exceeded Minor Flood Level	
14 October at 12:30 a.m.	Melbourne Water	Initiated update to predictions	Noted that river was rising faster than model prediction and began updated model runs.
14 October between 1:00 a.m. and 2:00 a.m.	Keilor gauge	Exceeded Moderate Flood Level	
14 October between 2:00 a.m. and 3:00 a.m.	Keilor gauge	Exceeded Major Flood Level	
14 October at 2:16 a.m.	Melbourne Water	Major Flood Warning to Bureau	Issued Major Flood Warning (5) to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was exceeding the Major Flood Level and falling; and The lower catchment was exceeding the Moderate Flood Level at Keilor and rising. It is expected to peak above the Major Flood level Friday morning at both Keilor and Maribyrnong.
14 October at 2:25 a.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River expected to peak above Major Flood Level on morning of 14 October.
14 October at 2:51 a.m.	Melbourne Water	Major Flood Warning to Bureau	Issued revised Major Flood Warning (6) to Bureau for the Maribyrnong River. It stated: <ul style="list-style-type: none"> The upper catchment was exceeding the Major Flood Level and falling; and The lower catchment was exceeding the Moderate Flood Level at Keilor and rising. It is expected to peak above the Major Flood level Friday morning at both Keilor and Maribyrnong.
14 October at 2:53 a.m.	Bureau of Meteorology	Flood Warning	Revised updated Major Flood Warning issued
14 October between 8:00 a.m. and 9:00 a.m.	Keilor gauge	Flood peak	Peak at more than 2.5m above Major Flood Level

Date and time	Agency/Data source	Action or warning type	Comment
14 October at 8:05 a.m.	Melbourne Water	Major Flood warning to Bureau	Issued Major Flood Warning (7) to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was exceeding the Moderate Flood Level and falling; and The lower catchment was exceeding the Major Flood Level and rising.
14 October at 8:10 a.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River expected to peak above Major Flood Level on morning of 14 October.
14 October at 1:47 p.m.	Bureau of Meteorology	Flood Watch	Includes wording that minor to major flooding occurring or expected across several Victorian catchments. Major flood warning current for Maribyrnong river.
14 October at 2:12 p.m.	Melbourne Water	Major Flood Warning to Bureau	Update of Major Flood Warning to Bureau Issued Major Flood Warning (8) to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was below the Minor Flood Levels and falling; and The lower catchment was exceeding the Major Flood Levels and steady.
14 October at 2:16 p.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River currently exceeding Major Flood Level and falling/steady. It is expected to drop below Major Flood Level on afternoon of 14 October.
14 October at 7:49 p.m.	Melbourne Water	Major Flood Warning to Bureau	Issued Major Flood Warning (9) to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was below the Minor Flood Levels and falling; and The lower catchment was: <ul style="list-style-type: none"> o exceeding the Moderate Flood Levels and falling at Keilor; and o exceeding the Major Flood Levels and falling at Maribyrnong.
14 October at 7:55 p.m.	Bureau of Meteorology	Flood Warning	Major Flood Warning for the Maribyrnong River. Maribyrnong River currently exceeding Moderate Flood Level and falling. It is expected to drop below

Date and time	Agency/Data source	Action or warning type	Comment
			Moderate Flood Level on evening of 14 October.
14 October at 11:54 p.m.	Melbourne Water	Major Flood Warning to bureau	Issued a downgraded Minor Flood Warning (10) to Bureau. It stated: <ul style="list-style-type: none"> The upper catchment was experiencing minor flooding; and The lower catchment was exceeding the Minor Flood Level and falling.
15 October at 12:00 a.m.	Bureau of Meteorology	Flood Warning	Minor Flood Warning for the Maribyrnong River. Maribyrnong River currently exceeding Minor Flood Level and falling. It is expected to drop below Minor Flood Level on morning of 15 October.
15 October at 11:42 a.m.	Melbourne Water	Final Flood Warning to Bureau	Issued Final Flood Warning (11) to Bureau. It stated that the Maribyrnong River catchment was below the Minor Flood Level and falling.
15 October at 12:19 p.m.	Bureau of Meteorology	Flood Warning	Final Flood warning for the Maribyrnong River.

11. The second question for clarification relates to a typographical error in Paragraph 122, where “...2002 Flood Event” should be changed to “...2022 Flood Event”.
12. The third question for clarification relates to the basis on which the number of 512 as the number of properties impacted by the Flood Event mentioned in paragraph 129 was calculated (as compared with the number of 293 as the number of properties that would be impacted by a 1% annual exceedance probability flood in accordance with the 2016-21 Flood Management Plan for Maribyrnong City Council). Melbourne Water correctly pointed out that in order to compare these two figures in an objective fashion, the same definition of “property” and extent of “flood impact” needs to be used in both assessments. However, whether this was the case or not is not clear, as details of the methodology used to obtain the numbers in the Flood Management Plan

and the number of properties impacted by the 2022 Flood Event provided to the Panel by Maribyrnong City Council are unknown.

13. For example, the number of 293 as the number of properties in the Flood Management Plan refers to the number of “residential” properties only, whereas the number of 512 properties is likely to refer to “all” properties. Consequently, it is not possible to make a direct comparison between the numbers of 512 and 293 properties, as is done in the report.
14. The fourth question for clarification relates to Table 3, including what the probabilities in Table 3 mean and why they differ (e.g., what the difference is between “flooding”, “once” and “more than once”), what level (in mAHD) these probabilities apply to and what methodology and assumptions were used to derive the information that is contained in Table 3.
15. The probabilities in Table 3 were calculated using the binomial distribution model, also called the binomial theorem or the binomial formula. This formula can be used to calculate the probability of a fixed number of occurrences of an event with a known probability occurring over a given period of time. For flooding, this corresponds to the probability that a certain number of flood events with a particular probability of exceedance will occur over a period of a given number of years.
16. In Table 3, the term “Flooding” indicates having one or more flood event in the given period of occupancy (i.e., 10, 15, 20, 30 years) that exceed the flood level of the indicated annual exceedance probability (i.e., 1% annual exceedance probability plus 600mm freeboard, 2% annual exceedance probability), the term “Once” indicates having exactly one event in that period of occupancy that exceeds the flood level of the indicated annual exceedance probability and the term “More than once” indicates having two or more events in that period of occupancy that exceed the flood level of the indicated annual exceedance probability. It should be noted that the annual exceedance probability that corresponds to “1% AEP plus 600mm freeboard” corresponds to an annual

exceedance probability of 0.5%, as it was assumed that the 600mm freeboard would elevate the properties to approximately the 0.5% annual exceedance probability level. Consequently, the percentages given in Table 3 are independent of any specific level in mAHD.

17. The fifth question for clarification relates to Recommendation 8 in the report, which states that “Melbourne Water should take account of the change in land use and projected changes to land use when setting flood levels for planning and development and the application of the Land Subject to Inundation Overlay.” Specifically, Melbourne Water was interested to clarify their understanding of this recommendation with the Panel, particularly with regard to the Panel’s reference to “projected changes in land use” and whether their response adequately covers the intent of the recommendation.
18. In their response to Recommendation 8, Melbourne Water indicated that any updates to their flood models would include any new developments that had occurred in the catchment and that updates to the relevant flood model could also be triggered by significant proposed changes in land use (e.g., greenfield areas, urban renewal precincts, big build projects). However, while the actions proposed in the response should all be implemented, they do not adequately cover the intent of the recommendation.
19. The intent of the recommendation was that plausible changes in future land use should be considered as part of different socio-economic development scenarios, in the same way as plausible future changes in rainfall are considered as part of different climate change scenarios. Given that future changes in land use can potentially have a larger impact on future flood risk than future changes in climate, and that changes in land use, unlike future changes in climate, can be influenced and controlled more easily at the local level, consideration of such future socio-economic development scenarios is critical in the proactive management of future flood risk.

20. It is recognised that consideration of such integrated scenarios and the exploration of the effectiveness of the full suite of risk reduction strategies (e.g., structural measures, land use planning (zoning), changes to building codes etc.) under these scenarios is not within the sole control of Melbourne Water but will require collaboration between relevant Government agencies. However, knowledge of the potential impacts of different plausible changes in land use in response to different socio-economic development scenarios will enable Melbourne Water to take a more proactive role in influencing future development and zoning to minimise future flood risk. This is especially important given that once development has occurred in an area, this is extremely difficult to reverse.
21. The sixth question for clarification relates to Recommendation 12 of the Panel report. This recommendation requires that Melbourne Water should seek the approval of the Minister for Planning to apply the interim planning controls designating the LSIO in locations where flooding occurred, pending the update to the Mid-Maribyrnong flood model. In response, Melbourne Water has queried why the Panel recommended the interim LSIO rather than using the s203 or s205 flood declaration power under the *Water Act 1989*.
22. The Panel accepts that there may be other mechanisms or methods to identify those areas in the Mid-Maribyrnong which, as a consequence of the October 2022 event, are now known to flood. The Panel notes Melbourne Water's commitment to determine suitable interim flood controls for those affected areas of the Mid-Maribyrnong and to implement these immediately. Any such mechanisms that are applied should be clearly and readily understood by affected landowners and statutory authorities. The mechanisms should control future development outcomes and be implemented with haste.

The Hon GT Pagone AM KC

Panel Chair

26 October 2023