BEFORE HEARING COMMISSIONERS
FOR THE PALMERSTON NORTH CITY COUNCIL

I MUA NGĀ KAIKŌMIHANA WHAKAWĀ
MO TE KAUNIHERA O PAPAIOEA

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of proposed Plan Change I: Increasing Housing Supply and Choice to the Palmerston North District Plan

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REPLY STATEMENT OF MARY WOOD
ON BEHALF OF PALMERSTON NORTH CITY COUNCIL

STORMWATER

Dated 22 August 2025

TABLE OF CONTENTS

A. INTRODUCTION 1
B. SCOPE 1
C. STORMWATER MODELLING APPROACH 2
D. EFFECTS MANAGEMENT VS STORMWATER OVERLAY 5
E. AVAILABILITY OF FLOOD DATA AND MODELLING 6
SUFFICIENCY OF STORMWATER ASSESSMENT REPORTING 6
SUMMARY 6
F. APPENDICES 7

A. INTRODUCTION

1. My name is Mary Wood.

2. I prepared a s 42A report dated 25 July 2025 (**"Report"**) on stormwater management for Plan Change I ("**PC:I**") for the Palmerston North City Council ("**the Council**").

3. My experience and qualifications are set out in my Report.

4. I repeat the confirmation given in my Report that I have read and will comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023 ("**the Code**"), and that this reply statement has been prepared in compliance with the Code.

B. SCOPE

5. In preparing this reply statement, I have reviewed the evidence prepared by Mr Jaggard on behalf of Kainga Ora. This reply statement addresses the following items raised by Mr Jaggard (and includes reference to items in his evidence):

   (a) Criticisms of the stormwater modelling approach:

      (i) Impervious coverage assumptions in the modelling (Mr Jaggard's Paragraphs 4.3, 4.4 and 4.5, 4.9, 4.20, 4.21);

      (ii) Impervious surface vs calculated land use (Paragraphs 4.10-4.15, 4.17);

      (iii) How timing of development is considered in the Stormwater Servicing Assessment ("**SSA**") (Paragraphs 1.5, 1.6, 4.8);

      (iv) How infrastructure improvements and local attenuation is considered in the model (Paragraphs 4.6, 4.17, 7.19); and

      (v) Modelling approach (Paragraphs 4.16-4.17, 4.19) resulting in conservatism in the Stormwater Overlay ("**the Overlay**") (Paragraph 5.3).

   (b) Effects management vs the Overlay (Paragraphs 4.19, 5.2, 5.5);

(c) Availability of flooding data (Paragraph 5.6); and

(d) Sufficiency of SSA reporting (Paragraph 4.19).

6. My response below does not respond to every matter raised by Submitters, and this should not be taken as acceptance of these matters. Where appropriate I have referenced my Report and that of other Council witnesses.

7. I am amendable to expert conferencing on stormwater and flooding matters, noting that this has not been possible at the time of preparing this reply.

C. STORMWATER MODELLING APPROACH

8. Mr Jaggard has stated that the modelling undertaken to date is overly conservative, as it assumes a significant increase in impervious coverage, and is inconsistent with proposed intensification development over the next 30 years (paragraph 4.16). He also questions whether stormwater capacity updates have been included in the assessment (paragraph 4.17) and supports Kainga Ora's position that the Overlay should be deleted due to a lack of sufficient assessment.

9. In considering Mr Jaggard's comments, I have reflected on the level of detail in modelling, flood mapping in the servicing assessment. coverage assumptions and how the results from the modelling were incorporated within the wider servicing assessment and development of the Overlay. My response to the modelling approach is provided in the following paragraphs.

10. Overall, I consider the level of detail in the model is appropriate for its use in supporting PC:I. considering industry guidelines (NZ Stormwater Modelling Guidelines,[1] (annotated extract is provided as Figure 1 in the Appendix).

11. Impervious coverage assumptions have been listed in the SSA Report (Section 3.2) for the city-wide assessment and within the Tonkin and Taylor ("**T&T**") Model Build report provided as Appendix C of the SSA (refer section 3).

12. Modelling at this city-wide basis typically considers impervious coverage across wide areas, rather than the detail of individual property coverage – this reflects

[1] National Stormwater Modelling Guide : Water New Zealand SW_ModellingGuide_AppendixC_ModelTypes_DetailedTables.pdf.

that some properties will have less coverage, and other properties will have higher coverage. While I understand Mr Jaggards point around some sites existing site may already be at or higher than 60% impervious surface coverage, I note that the converse can also be true – some sites may have less coverage.

13. I have enquired with T&T the development of the model and, as noted in the SSA on page 4, model runoff has been previously validated in 2018, outside of this plan change process.

14. I therefore do not consider Mr Jaggard's comments (paragraph 4.5) on what may or may not be allowed for in the Operative District Plan ("**ODP**") for current development to be material; the fact that the model has been validated in the past provides confidence in the representation of runoff. An assumption of 60% site coverage for existing residential land use for existing residential areas is, in my opinion, suitable for establishing current flood risk. I do not agree that additional information on selection of 60% coverage is necessary.

15. In response to Mr Jaggards' queries (paragraphs 4.9 and 4.20):

    (a) Future development intensification has been applied to the development areas (not roads) as shown in Figure 13 in the SSA.

    (b) In terms of the Central Business District ("**CBD**"), I enquired with T&T and I understand that large reserve areas in the CBD have been maintained as reserve areas in the modelling undertaken.

16. Mr Jaggard has provided calculations (paragraph 4.10-4.13) that consider yield estimates of likely new dwellings and then forecast impervious surface associated with those dwellings. Essentially, his view is that the level of development (based on estimated intensification dwellings) within the area will not result in 80% impervious coverage as modelled across the entire Medium Density Zone ("**MDZ**").

17. While I understand Mr Jaggard's point above, stormwater modelling at this level cannot define exactly where specific developments will occur in future and therefore the approach needs apply the change in impervious coverage across the MDZ to understand the sensitivity in flooding in response to these changes. Calculated dwelling numbers will depend on the minimum lot sizes assumed and

can vary. From a stormwater management perspective, linking dwelling numbers to impervious coverage offers little value particularly when considering flooding at a city-wide scale.

18. While the scale of infill that may occur over the next 30 years may differ from the impervious coverage modelled, I do not consider the modelling outcomes are overly conservative. The flood depth difference maps presented in the SSA (Figures 10, 11 and 12 of that document) show that the flood hazard in large events is relatively insensitive to changes in impervious coverage.

19. Mr Jaggard (paragraph 4.16) suggests that the modelling is overly conservative due to the scale of impervious coverage assumed resulting increased runoff (and the flood risks as he notes in 4.2). I disagree with this and consider that assessment of flood risk considering maximum likely imperviousness is appropriate as this prioritises locating dwellings appropriately, based on the best information currently available. This is particularly relevant in an area such as Palmerston North, where stormwater management upgrades to address flooding issues can be very costly to Council and the community, due to relatively flat topography and river boundaries limiting hydraulic grade. In addition, resolving flooding becomes increasingly difficult as areas become more developed, as the space to implement solutions become more constrained.

20. With regard to stormwater upgrades / capacity improvements (as queried by Mr Jaggard in 4.17), the potential for improvements has already been considered at a high level in the initial servicing assessment - refer to the spatial assessment undertaken in Section 3.1.1 of the SSA. In terms of the modelling, capacity improvements have not been modelled. This aspect is considered by the Council's current process of working with developers at a more detailed level and where necessary undertaking a more site specific assessment, identifying changes in pipe network, as well as possible landform and other improvements that would not otherwise be appropriate to include in a city-wide model.

21. Mr Jaggard questions how stormwater attenuation has impacted peak flows (paragraph 4.6). Local attenuation guidance has been developed separately by the Council[2] to support developers manage the effects of development in events up to a 10-year event. The effects of these tanks have not been

2 stormwater-attenuation-design-guide-dec-2019.pdf.

incorporated into the city—wide model and would likely have limited impact on the extent of flooding reported in a larger 50- or 100-year event. As per my comments in paragraph 10 of this reply, the level of detail in the model is appropriate for assessing food risk for this plan change – attenuation and local network capacity would be taken into consideration by the Council when reviewing applications at a site specific perspective.

22. Overall, I do not agree with Mr Jaggard's opinion that the modelling is conservative. The modelling represents the best available information for assessing flood risk for current and future land use.

D. EFFECTS MANAGEMENT VS STORMWATER OVERLAY

23. Mr Jaggard considers that a permitted activity framework would be more suitable (than the Overlay) to manage and control stormwater effects (paragraph 5.4)

24. In my opinion, permitted activity status would be challenging to achieve for stormwater effects without requiring the same level of site-specific assessment that Mr Jaggard characterises as 'red tape.' In my view, flood risk assessment in Palmerston North does require site-specific evaluation of factors such as local topography, existing overland flowpaths, cumulative effects, and appropriate mitigation measures. These matters would be very difficult to adequately addressed through permitted activity standards alone. Therefore, the regulatory burden would likely remain similar under either approach.

25. Without specific alternative provisions, it is difficult to evaluate whether any permitted activity framework could achieve the same level of flood risk management while genuinely reducing regulatory complexity. I acknowledge there remains an opportunity to discuss this at expert conferencing.

26. The Overlay is used to flag that additional assessment of stormwater and flooding effects may need to be considered – not that development cannot occur. The expectation is that this will provide the opportunity for additional information to be considered for each development at a more localised level and, where appropriate, additional and more detailed modelling may be undertaken. There may be circumstances where an application must be declined because the effects cannot be mitigated appropriately.

27. In terms of Mr Jaggard's suggested reduction in size of the Overlay, a 0.5m flood depth threshold to inform the overlay boundary would be inappropriate for Palmerston North. Palmerston North's flooding tends to be relatively shallow but widespread, creating risks across larger areas. The 150mm (0.15m) threshold in the 1 in 50-year event appropriately captures areas where flood effects could impact development and aligns with the Council's Engineering Standards

E. AVAILABILITY OF FLOOD DATA AND MODELLING

28. With regard to Mr Jaggards recommendation that the Council publishes its flood information and allow for download of the model at data (paragraph 5.6 of his evidence) I note that it is not unusual for within New Zealand for Councils to manage access to models – a primary driver for this is version control and models are updated and improved over time. The data from these models can be shared but understanding the results and the modelling context can be complex. The Council already works with developers to provide stormwater and flooding information, based on available model outputs and I consider this to be sufficient.

SUFFICIENCY OF STORMWATER ASSESSMENT REPORTING

29. Mr Jaggard has indicated that he does not consider the SSA reporting to be sufficient to support the Overlay (paragraph 5.2). I do not agree with this. While there are technical aspects of the modelling that could have been included as part of the overall documentation, in my opinion, the main aspects of the modelling and overall assessment were appropriately explained.

SUMMARY

30. Overall, I consider the Overlay to have been developed in a way that balanced available data alongside available modelling results. I do not consider that the Stormwater Overlay is conservative and do not agree that it should be removed.

Mary Wood

22 August 2025

F. APPENDICES

Dynamic/simple models

Table C-5: Dynamic/simple model examples

Example	Applications	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
High-level 2D	• Evacuation planning • Lifeline planning	2D domain model with direct rainfall, excluding hydrological losses or pipe network. No editing of DEM to represent channel conveyance.	×	✓	×	✓	✓
Medium detail 2D	• Strategic planning • Programme prioritisation	2D domain model with direct rainfall and hydrological losses, but no pipe network. DEM modified at significant structures on large open channels (culverts, bridges, etc.) to ensure flow continuity, if not accurate afflux	×	✓	✓	✓	✓
Detailed 2D	• Spatial planning • District Plan development • Regional or District Plan changes • Long Term Plan development • Multiple lot stormwater design with known existing risk (to site or downstream)	2D domain model with direct rainfall and hydrological losses, but no pipe network. Detail is added at significant structures on large open channels to determine accurate afflux. Soakage losses are incorporated into infiltration loss.	×	✓	✓	✓	✓

Dynamic/complex models

Table C-7: Dynamic/complex model examples

Example	Applications	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
1D models	River system modelling	Models of large waterways, smaller contributing channels, and possibly overland flow paths where flow remains in-channel or where optimisation, testing of operational control, or many simulations are required. Detailed lumped subcatchment hydrology.	✓	×	✓	✓	✓
Integrated	• Stormwater catchment management planning • Infrastructure design and upgrades • Level of service assessment, renewal and maintenance • Large lot land development planning	Commonly built by Councils. Comprehensive representation of overland flow with representation of significant flood plain obstacles and major primary pipe networks. Significant topographic and primary stormwater features that influence flows outside the study area are explicitly represented (such as significant culverts and open channels). Direct rainfall or detailed lumped hydrology with allowances for infiltration and drainage systems.	✓	✓	✓	✓	✓

Figure 1 Extracts from NZ Modelling Guidelines (emphasis added)