IN THE MATTER: of the Resource Management Act 1991 (**RMA**)

AND

IN THE MATTER: of Proposed Plan Change 93 (Te Puna Springs) to the Western Bay of Plenty District Plan under Schedule 1 of the RMA.

STATEMENT OF EVIDENCE OF KATHLEEN THIEL-LARDON ON BEHALF OF BAY OF PLENTY REGIONAL COUNCIL STORMWATER AND FLOODING

1 July 2022

INTRODUCTION

1. My full name is Kathleen Thiel-Lardon.

2. I am employed by Bay of Plenty Regional Council (Regional Council) as a senior environmental engineer. I have held this role since September 2015.

Qualifications and experience

3. I hold a Diplom-Ingenieur / Master's Degree in Science majoring in civil engineering. I obtained this qualification from the University of Rostock (Germany) in 2005.

4. My degree has been assessed by the New Zealand Qualifications Authority as equivalent to a Bachelor of Engineering with Honours degree from a New Zealand university, Level 8, in May 2007.

5. I have been registered as a chartered professional engineer in New Zealand since 22 December 2011 and I am a chartered member of Engineering New Zealand (formerly MIPENZ) since December 2011.

6. I am a registered International Professional Engineer since 11 July 2019.

7. I have approximately 15 years' experience working as an engineer.

8. As a senior environmental engineer at the Regional Council my responsibilities include:

   (a) Undertaking professional engineering design and investigations for river schemes, drainage, coastal and soil conservation activities;

   (b) Implementing appropriate engineering projects;

   (c) Providing technical advice to Council groups, outside organisations and the community for regional plans, strategies, policy development and processing of resource consents, including flood risk assessments and mitigation; and

   (d) Providing supportive technical leadership to, and reviewing the work of, the Regional Council's junior engineering staff.

9. Prior to being employed by the Regional Council as a senior environmental engineer, my work experience included:

   (a) Working as Senior Project Manager for one year for Beca Limited. This role involved me providing technical advice to various local government agencies for the preparation of 30-year Infrastructure Strategies and Asset Management Plans relating to the three water services which are made up of drinking water, wastewater and stormwater.

   (b) Working as Engineer for two years for our family business, Professional Management Services 2009 Limited. This role involved me managing engineering projects, including sub-

division developments and the preparation of a Catchment Management Plan for Western Bay of Plenty District Council's Central and Eastern Catchments.

(c) Working as Team Leader Engineering for three years for Spiire Limited (formerly CPG New Zealand Limited). This role involved me managing a team of engineers and managing engineering projects Spiire was involved with, including sub-division developments, capital works projects relating to the three water services and the preparation of a Catchment Management Plan for Western Bay of Plenty District Council's Western Catchments.

(d) Working for five years as a project engineer for CPG New Zealand Limited (formerly Duffill Watts Group / Duffill Watts and King Limited). This role involved me carrying out engineering work on a number of projects many of which related to the three water services.

(e) Working for three years as a surveying technician for a regional council in Germany.

10. I co-authored the latest Bay of Plenty Regional Council Guidelines for the design, construction, maintenance and safety of small detention dams (2022/01).

11. I have been involved with the Plan Change since the submission stage. My involvement included input into Regional Councils submission and ongoing discussions after lodgement and submissions.

12. I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing this evidence, and I agree to comply with it while giving oral evidence before the hearing committee. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence. I acknowledge that in giving this evidence, my duty is to the Hearing Commissioners and not to my employer.

Assumptions and evidence considered

13. For the purposes of my evidence, I have considered the following:

    (a) Plan Change Request and Section 32 Analysis Te Puna Springs Private Plan Change 93, dated 13 October 2021;

    (b) Submitter Letter Te Puna Springs Private Plan Change 93, dated 19 May 2022;

    (c) Memorandum Te Puna Springs Private Plan Change 93, Response to BOPRC Stormwater-related Submissions, dated 31 May 2022;

    (d) Western Bay of Plenty District Council - Rural Areas and Small Settlements Flood Mapping Tonkin and Taylor February 2021 and associated shapefiles (flood extent, flood depth, maximum depth x velocity, version 2, October 2021);

    (e) Planner's Report for Plan Change 93 – Te Puna Springs, dated 6 July 2022; and

    (f) The evidence of Neil Raynor and Aaron Collier for the Applicant.

14. I was involved in direct discussions with the Applicant's technical team post-submission.

15. For the purposes of my evidence, I have **not** considered any effects related to stormwater quality, effects on stream base flows and ecological values of the receiving environment. Those matters are addressed by other experts. I identify where I rely on their evidence.

SCOPE OF EVIDENCE

16. My evidence will address the stormwater effects and proposed mitigation measures for PC 93, and specifically whether I consider that a feasible stormwater solution can be achieved for PC93 within the area identified for stormwater management in the proposed Structure Plan. As I understand it, stormwater management is the key outstanding issue between the PC93 Applicant and the Regional Council.

Note figures referenced in my evidence below are set out in a separate technical appendix which accompanies this brief.

CATCHMENT AND SITE CONTEXT

17. The plan change area lies within the Oturu Catchment a Secondary (2nd order) Catchment of the Tauranga Harbour catchment. The hydraulic performance of the Oturu Creek, and its tributaries and associated catchments within the plan change area is reasonably well understood, based on the Western Bay of Plenty District Councils Rural Areas and Small Settlements Flood modelling investigations. ***(Figure 1)***

18. The Plan Change Area currently has overland flow paths that directly flow from the upper catchment to the unnamed tributary of the Oturu Creek. ***(Figure 2)***

Existing Flood Extent and Depth

19. For the 1% Annual Exceedance Probability (AEP) 2130 event the following is noted:

    (a) Significant spilling into the floodplain is evident throughout the middle and lower reaches of the catchment. A number of roads including State Highway 2, Armstrong Road and Borell Road are inundated by floodwaters, some greater than 1m deep. ***(Figure 3&4)***

    (b) Substantial flooding exists upstream of the kiwi rail embankment with flood depth greater then 6m, however, due to the height of the embankment of approximately 12m no overtopping is occurring. ***(Figure 5)***

Existing Flood Hazard Vulnerability Thresholds

20. Human interaction with the floodplain and the associated exposure to the flood hazard within the floodplain can create hazardous conditions. Fast-flowing shallow water or slow-flowing deep water can equally present a hazard. As such considering the flood depth and velocity in combination (D × V product) is recommended to assess Vulnerability Thresholds.[1]

21. For the 1% AEP 2130 event the maximum D × V product identifies that a number of roads become unsafe, including Armstrong Road and Borell

[1] Australian Institute for Disaster Resilience - GUIDELINE 7-3 Technical flood risk management guideline: Flood hazard

Road as well as a number of private property access along Armstrong Road. However, during the design storm none of the existing building are vulnerable to structural damage based on the model outputs. ***(Figure 8&9)***

THE NEED FOR AN INTEGRATED STORMWATER ASSESSMENT

22. Effects from stormwater discharges are often only assessed as significant when considered cumulatively. Gradual increases in flow through development may not be noticeable daily. However, over time and as development within a catchment increases, these small increases in flow collectively combine, often leading to significant effects. The need to consider effects collectively necessitates a catchment or sub-catchment based approach.

23. Paragraphs 17 to 21 of my evidence demonstrates that existing flooding occurs within the catchment. Incremental increases in the volume and flow rate of stormwater from the plan change area, if insufficiently mitigated, has the potential to cause adverse effects. These adverse effects could include:

    (a) An increase in velocity, flood depth, and flood extent resulting in:

        (i) Increasing stream bank erosion and channel instabilities from faster or higher flows;

        (ii) Larger areas that are flooded above the key flood hazard threshold for depth and velocity (D × V) for people, property and infrastructure that may lead to (or contribute to) loss of life, personal injury, damage to property, disruption of day-to-day life to individuals and businesses, and the provision of community infrastructure.

        (iii) A decrease of emotional wellbeing of affected downstream landowners and business owners.

    (b) An increase in duration resulting in:

        (i) Increasing stream bank erosion and channel instabilities from extended periods of elevated flows;

(ii) Increasing the length of time structures (such as bridges/culverts, road embankment and kiwi rail embankments) might be flooded above the key flood hazard threshold for depth and velocity (D × V) that may lead to (or contribute to) a reduced performance of the asset or failure of the asset and longer exposure to hazardous conditions.

24. These increases in flood depth, extent and flow can be caused by an increase in impervious surfaces on the site (i.e. the new commercial zones) or by a loss of existing flood carrying capacity and flood storage due to the development of the land. ***Figure 7*** highlights potential flood storage displacement, which would need to be mitigated.

25. As more and more rain falls, stormwater design concerns shift from volume reduction (through infiltration) to pollution reduction, erosion reduction, flooding reduction, and floodplain management. In each of these five levels of stormwater management, there is an opportunity to incorporate volume-based stormwater management to mimic the pre-development hydrological cycle to the maximum extent practicable using integrated stormwater management planning.

ASSESSMENT OF STORMWATER EFFECTS OF PC93

26. The control of the additional volume of runoff created by PC93 is necessary to ensure that the change of land use of the site does not result in adverse effects on the receiving environment, in this case the Oturu Creek.

27. Any potential effects of flood storage displacement or any changes to the flood carrying capacity of the streams through the site need to be managed to avoid offsite effects.

28. At the moment, there is no overarching stormwater management plan that demonstrates that the proposed stormwater management is the best practicable option, taking into consideration the existing site features and the constraints of the receiving catchment as a whole.

29. The Regional Councils Hydrological and Hydraulic Guideline (2012/02) and the BOPRC Stormwater Management Guidelines (2012, updated

2015) require peak discharges and total runoff volume to be managed to mitigate effects.

30. The above guidelines describe a catchment-wide analysis as a preferred method for an assessment. This is because the attenuation of peak discharge as a single flood indicator alone cannot reflect the flood process properly and as such the potential effects of increased volume are not fully understandable.

31. For the reasons explained earlier relating to cumulative effects of land use decisions on flooding, usually during a structure planning process, a catchment-wide analysis should be undertaken. The WBOPDC has developed a flood model which spans this catchment. It is unclear why the model has not been considered.

32. Where a catchment-wide analysis does not exist, the default recommendation of stormwater design, is that it be designed to attenuate to 80% of the 100-year Average Recurrence Interval (ARI) pre-development flows and match the 10-year and 2-year ARI pre-development flows to ensure there are no downstream impacts from increased runoff. This is the method which the applicant has chosen to pursue.

33. However, in using this method, the applicant has not been able to demonstrate a feasible proposal that relies on using a stormwater management system that is appropriate from an environmental perspective.

34. Resultantly, I undertook a desk-top investigation to determine the feasibility of the applicant's proposed approach to stormwater management.

35. My investigation involved undertaking rough volume calculations, utilising 2021 lidar information. I have created cross-sections spanning the gully system at 20m intervals from the existing dam location to determine whether or not, within the constraints of the proposed Commercial zoning, there was sufficient space for the volume of water which needs to be detained on site.

36. For the large on-line attenuation pond, the applicant determined that 8300m^3 of storage would be required to attenuate the volume needed to release post-development peak flows in the100 year ARI back to 80% of the pre-development level, at a flood level of 14.77.

37. A 4000m^2 area had been identified by the Applicant within the green space area of the Structure Plan to accommodate the majority of the storage.

38. Using basic cross-section calculations, I calculated that approximately 5250m3 of space would be available without requiring significant earthworks. If the site were earth worked to create more volume, then, based on using 1 in 3 batter slopes within the red area shown in the ***Figure 10***, I estimate that there is approximately 7300m^3 available for attenuation. This is about 1000m^3 short of what is needed.

39. However, I understand that the Applicant is also proposing to utilise the constructed stormwater treatment and extended detention wetlands/ ponds on either side of the main on-line attenuation pond to contribute to the overall storage.

40. So, whilst there may potentially be enough space for attenuation, significant earthworks within the mainstream itself and associated embankments would be required. This also means that the constructed stormwater treatment and extended detention wetlands would sit on the fringe of steep embankments. This raises stability concerns, and a geotechnical investigation would be required.

41. Having said this, the current proposal for the structure plan area only recommends the attenuation of runoff and the loss of flood storage, leading to the displacement of flood waters which I discussed earlier, has not been assessed. Therefore, I do not consider that a fulsome assessment of off-site effects has been undertaken.

42. There is also the requirement for the applicant to demonstrate that there is sufficient space within the structure plan area to accommodate water quality treatment and extended detention devices. Extended detention is needed to reduce potential accelerated stream channel erosion as a result of new impervious areas.

43. Resultantly, and in addition to the on-line attenuation pond, I also investigated whether or not there would be sufficient space available for the stormwater treatment and extended detention wetland within the green corridor between the commercial zones.

44. This also includes a 3m area surrounding the ponds, needed for safety and maintenance purposes. However, it does not include a maintenance tract down from the development, which would need to be at much gentler grades.

45. For the northern constructed treatment and extended detention wetland:

    (a) From my calculations, I can conclude that the length shown by the applicant is not achievable due to the interference with the existing dam embankment. Moving the pond further to the west is also not feasible as it would interfere with the hall property. ***(Figure 11)***

    (b) This means that this pond would need to be made wider, which would interfere with the zoning to the north and may potentially not meet the length to width ratio requirements within the BOPRC stormwater management guidelines (2012, updated 2015).

    (c) I am also concerned that there is a potential for the dam embankment to erode due to the proximity of concentrated flow from the wetland and extended detention upslope from it. I am also concerned about the stability of the slopes around the wetland during the drawdown of the dam.

46. For the southern constructed treatment and extended detention wetland:

    (a) From my calculations based on the existing cross sections, I can conclude that this constructed wetland would be partially situated within the southern tributary (red circled area in ***Figure 12***).

    (b) Given that the applicant has indicated that this wetland will be 'off-line' and not impact the main stem of the southern tributary, the location of the wetland would need to be extended southwards into the proposed commercial zone.

47. The stormwater report provided by the applicant states that any stormwater management approach can be refined at later development

stages, but it fails to identify how this can be undertaken to ensure that the cumulative effects of commercially zoned land within PC93 as a whole are comprehensively managed to ensure that the downstream flood risk is not increased.

48. The current stormwater management approach also relies on accommodating all the attenuation needed for the site within an on-line stormwater attenuation pond, which will lead to effects within the stream system and loss of the raupo wetland. These effects are discussed further in Mr Keith Hamill's evidence.

49. For the reasons provided in my evidence, I disagree with the Planner's report, which states that a conservative approach to stormwater management has been undertaken for the structure plan area.

50. Additionally, I disagree with the Planner's report and the applicant's evidence that existing provisions within the WBOP District Plan are sufficient. I note that the existing Western Bay Development Code[2] is outdated. It should not solemnly be relied on for setting design standards, for example, the Code requires the secondary flow path from surface water to be protected for the 2% AEP event[3] not the 1% AEP that should be considered under NZS 4404:2010[4] and the primary analysis for flood risk under the RPS Appendix L.

51. In order to meet the intent of the RMA and to give effect to the NPSFM provisions for integrated management of land use and development effects on freshwater receiving systems (s.3.5.1(c)) and the protection of values, and RPS provisions for managing natural hazards (Policy NH 4B), the Structure Plan needs to consider an integrated approach for stormwater management. These provisions have been considered by Mr Nathan Te Pairi in his evidence.

52. Overall, my conclusion is that it is highly unlikely that an appropriate stormwater management solution can be accommodated within the footprint identified in the Structure Plan, and changes to the areas of commercial zoning would be required.

---

[2] Western Bay of Plenty District Council 2009 Development Code
[3] Chapter DS5 Stormwater Design 5.1.2
[4] New Zealand Standard – Land Development and Subdivision Infrastructure

PROPOSED PROVISIONS

53. In the event that a stormwater solution was able to be identified, I would support the inclusion of detail provisions in the Structure Plan to address the risks associated with the volume and attenuation of stormwater.

54. In this regard, to provide sufficient certainty to future designers and ensure that the intended objectives of the Plan Change can be achieved, I recommend that performance measures and design criteria for stormwater management be established.

55. I also recommend that appropriate stormwater modelling be undertaken to accurately assess the relevant large storm event attenuation needs for the site as this could impact on the feasibility of the proposed solutions.

56. I also recommend that any approach for stormwater management adopt a water-sensitive design approach across the whole plan change area. - In my opinion, stormwater management for the PC93 area needs to include runoff reduction measures (such as at-source measures) to reduce the impact of an extended duration of flooding. This point is discussed further by Mrs Sue Ira.

CONCLUSIONS

57. The hydraulic performance of the Oturu Creek, and its tributaries and associated catchments within the plan change area is reasonably well understood, based on the Western Bay of Plenty District Councils Rural Areas and Small Settlements Flood modelling investigations.

58. The applicant has not used the WBOPDC hydrological model to assess the effects of the plan change on the wider catchment. This is of concern given the existing flooding which occurs within the Oturu Creek catchment.

59. Based on my assessment, it is highly unlikely that an appropriate stormwater management solution can be accommodated within the footprint identified on the Structure Plan and changes to the areas of commercial zoning would be required.

60. An integrated approach to stormwater management needs to be undertaken for the plan change area, ensuring that flood mitigation

requirements are integrated with water quality treatment requirements and the values of the streams.

61. This integrated approach needs to be set through provisions within the district plan to ensure PC93 will not cause detrimental effects to the receiving environment.

DATE 1 July 2022

KATHLEEN THIEL-LARDON