IN THE MATTER OF the Resource Management Act 1991

AND

IN THE MATTER OF Private Plan Change 95 Pencarrow Estate Pongakawa to the Western Bay of Plenty District Plan

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STATEMENT OF EVIDENCE OF DANIEL HIGHT
(ENGINEERING, FLOODING AND NATURAL HAZARDS)
ON BEHALF OF KEVIN AND ANDREA MARSH

Introduction

1. My full name is Daniel James Hight.

2. I am a Partner and the Engineering Team Leader at Lysaght Consultants, an engineering, surveying, planning and land development consultancy. I am a Chartered Professional Engineer with a Bachelor of Engineering Degree (Honours) from the University of Canterbury. I have approximately 16 years of engineering consultancy experience, including 12 years in the Bay of Plenty. I have been involved in large complex development projects including:

   (a) The Three Creeks Estate SHA development in Adler Drive, Tauranga, a complicated 200 + lot residential development including the resolution of considerable earthworks, retaining wall, and stormwater issues.

   (b) The Golden Sands development in Papamoa, a multi-stage, large-scale residential development.

3. I act on behalf of Lysaght's client, Kevin and Andrea Marsh, the applicant. I lead the team responsible for the Proposed Private Plan Change - Engineering Servicing Report (dated 22/08/2024, Revision 7) and the engineering design presented within it. Further, I have authored two addendum letters (dated 05/04/2024 and 22/08/24) that support that servicing report.

Code of Conduct for Expert Witnesses

4. I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses, as contained in section 9 of the Environment Court's Practice Note 2023, and I agree to comply with it.

5. The data, information, facts and assumptions that I have considered in forming my opinions are set out in my evidence that follows. The reasons for the opinions expressed are also set out in the evidence that follows.

6. I confirm that the matters addressed in this brief of evidence are within my area of expertise, with the exception of where I confirm that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from my opinions expressed in this brief of evidence. I have specified where my opinion is based on limited or partial information and I have identified any assumptions I have made in forming my opinions.

Scope of evidence

7. My evidence will:

   (a) Summarise the proposed civil engineering works and infrastructure required to service the proposed plan change development area;

(b) Summarise my assessment of potential effects on existing infrastructure networks and the surrounding environment as a result of infrastructure to service the development enabled by the plan change, and the natural hazard risks as affected by the development enabled by the plan change, and recommendations to address those effects as required;

(c) Respond to matters raised in submissions;

(d) Respond to matters raised in Council's s.42A report; and

(e) Comment on the proposed rules as relevant to achieving recommendations in respect of infrastructure and natural hazard effects management.

8. I have read and am familiar with the private plan change application, the submissions, the s 42A report and the proposed plan change. I have carried out a visit to the site.

9. I have relied on:

(a) Innoflow's Onsite Wastewater Treatment System – Technical Memo (dated 03/04/24) for sizing the wastewater treatment and disposal infrastructure, and for confirming general feasibility of the site and system for the development enabled by the plan change. Innoflow are an established supplier of advanced wastewater treatment and disposal systems, with a track record of supplying similar systems in the region;

(b) CMW Geosciences' Geotechnical Investigation Report ("GIR") for Plan Change (TGA2021-0096AC, Revision 0, dated 11/02/2022) for

geotechnical analysis of the site soils and recommendations for foundation designs. CMW are an established geotechnical firm with qualified and experienced geotechnical engineers and engineering geologists.

(c) The evidence of Mr Coles concerning natural hazard risk assessment. The evidence of Mr Coles and Mr Murphy also addresses engagement with power and communications providers. The qualifications of Mr Coles and Mr Murphy are set out in their statements of evidence.

(d) Harrison Transportation's Transportation Assessment Reporta for analysis of transportation effects of the development enabled by the plan change. The qualifications of Mr Harrison (the author of that report) are set out in their statements of evidence.

Executive summary

10. Lysaght has undertaken preliminary design and serviceability assessments of the proposed Plan Change area. I consider that the development of the site (in accordance with the proposed structure plan, the recommendations of the experts that have contributed to the application, and the proposed planning rules) can be undertaken using WBOPDC Development Code compliant engineering solutions to provide similarly compliant levels of service to the residents of the plan change area. I don't believe that the development will have any perceptible effects on other properties in terms of level of service or exposure to hazards.

Proposed plan change

11. It is proposed to re-zone 10.03ha of land at 1491 State Highway 2, Pongakawa from Rural to a mixture of Residential and Commercial. A total of 9.66ha of land is proposed as Residential (which includes multiple reserve spaces,

overland flowpaths, and roading and utility corridors), with the remaining 0.37ha proposed as a Commercial area. This is expected to enable delivery of a maximum of 120-130 dwellings and a small commercial area accommodating a local shop/café/community health hub or flexible use space for community services. The proposed wastewater treatment system and disposal area north-east of areas to accommodate development would remain zoned Rural.

12. The plan change is proposed to enable supply of housing and community/social infrastructure to the Pongakawa residential community, responding to growth in intensive horticulture and the establishment of the Rangiuru Business Park in the area. Full details of the particulars of the proposal are covered in the planning evidence of Mr Coles and Mr Murphy.

Potential infrastructure and civil engineering design features

13. A detailed earthworks design has not been undertaken at the site, but high level investigations confirm that a suitable landform can be formed using conventional earthmoving techniques. CMW's Geotechnical Investigation Report confirms that the soils at site are generally suitable for use as fill and in supporting building platforms (with the exception of some localised organic Peat materials that will need to be cut to waste).

14. Network wide transportation effects have been assessed by Mr Harrison in his evidence. Detailed design of the transportation network internal to the site (eg. road geometry) can and will be undertaken in accordance with the WBOPDC Development Code (2009).

15. Stormwater treatment and disposal has been considered by Lysaght in some detail. A conceptual design has been provided that includes the disposal of primary stormwater to ground for all private properties, and allows the reticulation of runoff from roads within the site (and a small portion of the private properties) to a treatment and attenuation wetland/pond. Further, a

pre-treatment swale has been included in the design immediately upstream of the wetland, to provide an additional level of treatment. That system has been designed to ensure a level of treatment compliant with the BOPRC Stormwater Treatment Guidelines can be achieved, and that runoff rates from the site are attenuated to pre-development rates for all storms up to and including 1% AEP events.

16. Overland flowpaths have been incorporated into the design to ensure that flow from upstream catchments is conveyed through the site without having any effect on the flood hazard exposure of any properties external to the site. The flowpaths have been sized to ensure that they can convey runoff in all storms up to and including 1% AEP storms. All adjacent building platforms can and will be designed to ensure that all buildings have WBOPDC Development Code compliant freeboard above any adjacent water within the flowpaths.

17. Innoflow have prepared a wastewater treatment and disposal system to serve the entire site. Each lot is to have its own primary treatment tank, from which sewage will be pumped via a pressurised system to a central secondary treatment system and disposal field. That disposal field is located more than 20 metres from any watercourse, in accordance with the BOPRC On-site Effluent Treatment Regional Plan.

18. Two potable water supply options are presented in Lysaght's Engineering Servicing Report[1]. Both options can provide WBOPDC Development Code compliant water supply to the entire site. This includes sufficient pressure to meet firefighting supply requirements of 25l/s, while maintaining a code compliant residual pressure within the network. The preferred option is to be determined during the subsequent resource consent or detailed design phases, likely depending on construction cost, though it is noted that

[1] Lysaght Engineering Servicing Report (Revision 7) dated 22 August 2024, Appendix C of Response to Further Information Request dated 30 August 2024.

WBOPDC's preferred option is Option 1, being the upgrade of the 2km long main from Maniatutu Road reservoir to the Arawa Road settlement.

Natural hazard effects

19. Filling within the site to form building platforms and roads will have no perceivable displacement effect on the downstream WBOPDC modelled floodplain, given that the floodplain is infinite in scale and contiguous with the ocean. Further, a large portion of the site is not identified as floodable during the 1% AEP storm event and has a substantial freeboard above the flood plain.

20. As a result of the design of the stormwater treatment, attenuation and disposal system and overland flowpaths through the site, there are no expected increases to the flood hazard exposure of any properties (ie. downstream properties as a result of increased runoff, or upstream properties as a result of impediment to overland flow). Further, the stormwater system will ensure that there are no adverse effects on the Puanene Stream immediately adjacent to the site.

21. The site can be designed such that no buildings within the development are exposed to flood hazard in a 1% AEP storm, by way of providing appropriate freeboard above any predicted floodwater. More specifically, any building within the development area will be more than one metre above the broad flood plain north of the site (RL 4.46m), and more than 500mm above any adjacent overland flowpath passing through the site.

22. The overland flowpaths within the site will be planted to minimise erosion and ongoing maintenance effort. That planting will create an effective barrier to entry into the flowpaths, and can be accompanied by fencing to completely prevent entry if required.

Submissions on the plan change

23. Submissions received on the plan change have been reviewed. As they relate to infrastructure and natural hazards, matters raised are addressed below.

Susceptibility to flooding and existing flooding effects

24. Numerous submissions discuss the susceptibility of the site to flooding, and the potential for existing flooding effects to be exacerbated or extend to affect neighbours in the existing Arawa Road settlement. Particular concern is raised with respect to flood risks to the on-site wastewater disposal field. As explained above and in the Lysaght Engineering Servicing Report[2], the development will have no perceivable effect on the exposure of other properties to flood hazard, including those in the upstream Arawa Road settlement.

25. Some submitters noted that the proposed wastewater disposal field will be within the downstream flood plain. I understand from discussions with Innoflow that the wastewater being discharged to shallow ground via the dripline irrigation field will be relatively clean, having already passed through both a primary (on-lot) and secondary (centralised) treatment device. BOPRC's Onsite Effluent Treatment Regional Plan states that wastewater disposal fields must be clear of flood water in a 20-year storm. While no modelling has been done of the 20-year storm event, it is a safe assumption that the flood water levels in that storm will be lesser than in the 100-year storm. WBOPDC's flood modelling suggests that the disposal area is largely clear of the predicted 100-year storm flood waters, which are predicted to reach a level of RL 4.46m. Therefore, it is likely that less of the wastewater disposal field is subject to the flooding that would be present during the 20-year storm, and that minor amendments to either the detailed design of the system layout, or minor

[2] Lysaght Engineering Servicing Report (Revision 7) dated 22 August 2024, Appendix C of Response to Further Information Request dated 30 August 2024.

earthworks to lift ground levels could be carried out to ensure compliance with the Onsite Effluent Treatment Regional Plan. Therefore, I consider the risk of effects arising as a result of floodwaters passing over the dripline irrigation field to be low.

Quality of stormwater discharge

26. Several submissions discuss concerns with the quality of stormwater to be discharged from the plan change site. A BOPRC Stormwater Management Guidelines compliant solution has been provided, primarily by way of a treatment wetland incorporated into the stormwater pond proposed at the downstream end of the proposed stormwater network. An appropriate land area has been set aside to allow the provision of a pre-treatment swale immediately upstream of the wetland, an accessible wetland forebay for maintenance, banded bathymetry within the main wetland, and extended detention, all of which contribute to both a complaint level of runoff treatment and a reduction in erosion and scour of the downstream environment.

Groundwater depth

27. WBOPDC's submission raised doubt that the groundwater beneath the site was deep enough to allow the installation of stormwater soakage devices and the stormwater pond/wetland[3]. The groundwater depth has been measured across the site and is approximately 3m below the surface of the ground in the development area and therefore is not expected to be constraint to ground soakage. This has been confirmed by CMW.

Potable water supply pressure

28. Several submissions raise concerns with the adequacy of existing water pressure in the local network and whether this will be worsened by the

proposed development. Water network modelling was carried out to inform the Lysaght Engineering Servicing Report[4], and that modelling confirmed that:

(a) Under option 1 (the upgrade of the 2 kilometre main to Maniatutu Road), the pressure available in Arawa Road would be improved from what is currently available, and sufficient to also meet firefighting requirements. At present, the WBOPDC network is not capable of delivering a compliant fire-fighting water supply to the Arawa Road settlement.

(b) Under option 2 (the provision of a reservoir servicing the subject site only), the pressure available in Arawa Road would be reduced from a minimum of 49m to 46m head, still well above the WBOPDC minimum level of service of 30m head.

BOPRC submission

29. BOPRC's submission suggested that the development should consider the potential effects of NZTA and/or Kiwirail making changes to upstream bridges and culverts, and therefore potentially changing the amount of runoff that may pass through the site. In both Lysaght addendum letters (dated 05/04/2024 and 22/08/24), Lysaght contended that the applicant should not be responsible for mitigating against the effects of works that may or may not be undertaken on upstream properties. Instead, the effects of any such works should be assessed by the party undertaking them at the time.

Section 42A report

30. I have read the Section 42A report, and have summarised below my responses to the key points raised within it that aren't otherwise already addressed in

[4] Lysaght Engineering Servicing Report (Revision 7) dated 22 August 2024, Appendix C of Response to Further Information Request dated 30 August 2024.

Lysaght's Engineering Servicing Report[5], Lysaght's two addendum letters, or elsewhere in this evidence.

31. Under Topic 4 addressing natural hazards, the issue of safe evacuation routes is raised, particularly in relation to how residents are able to pass across overland flowpaths. I consider those concerns to have been addressed with some subtle amendments to the overland flowpath design in the latest structure plan. Specifically, Overland Flowpath 1 has been realigned to the site's southwestern boundary such that no dwellings will be prevented from reaching a road by having to traverse an overland flowpath. Overland Flowpath 2 is now proposed to be contained within a vested stormwater reserve, meaning that all residential lots will have uninterrupted vehicle access to a road.

32. Under Topic 6 addressing water supply, various issues are raised that I have responded to below. Generally, WBOPDC support Option 1, being the proposed upgrade to the main from the Maniatutu Road reservoir, and do not support Option 2, being the reservoir and pump solution. I concur that Option 1 is the preferred solution.

33. In paragraph 13.22, issues with the water supply modelling are raised. Firstly, WBOPDC suggest that the pressure modelled within the Maniatutu Road reservoir doesn't match with the actual elevation of the reservoir. The figure used in the model was iteratively set at 100m to ensure that the pressure within the network model at the water test location was in accordance with the actual test. The test data collected recorded 56m of head at the very lowest ebb of the 48-hour test, and that was reduced further to 51m of head for conservatism in the modelling. Further modelling can be done in collaboration with WBOPDC to ensure that the proper pipe diameter is selected for the

[5] Lysaght Engineering Servicing Report (Revision 7) dated 22 August 2024, Appendix C of Response to Further Information Request dated 30 August 2024.

upgrade. Minor amendments to the pipe size will not significantly change the cost of the upgrade works.

34. WBOPDC request that summer testing be done on the water network, instead of the testing that was already done in July, 2022. As above, further modelling can be done in collaboration with WBOPDC to ensure that the proper pipe diameter is selected for the upgrade.

35. WBOPDC state that the model incorrectly includes only 29 existing properties. The reference to 29 properties in Lysaght's Engineering Servicing Report[6] is in reference to a single node within the model and is stated as an example of how demand was calculated. The complete model includes demand from more than 60 properties as stated by WBOPDC, spread across a number of nodes.

36. WBOPDC state that a Hazen Williams roughness coefficient of 140 should be used, instead of the 150 used in the model. I have rerun the model for Option 1 with a revised roughness coefficient, and can confirm that the modelling results remain compliant with the requirements of WBOPDC's development code. The lowest residual pressure at any node within the development while 2 hydrants are drawing 12.5 l/s is 17m. Minor adjustments to pipe diameters within the proposed development have a significant impact on the pressures at the furthest nodes in the network, and there may be more efficient detailed designs available that could further improve these results. However, I am satisfied that the proposed upgrade to the main from Maniatutu Road paired with a suitable internal site design can provide a code compliant water supply network to the site and the wider Arawa Road settlement.

37. Under Topic 8 addressing stormwater, a number of issues are raised that I have addressed below. Those issues can be broadly categorised as follows:

[6] Lysaght Engineering Servicing Report (Revision 7) dated 22 August 2024, Appendix C of Response to Further Information Request dated 30 August 2024.

(a) The need to prepare a stormwater management plan at this stage of the development.

(b) The means by which overland flowpaths can be culverted beneath roads.

(c) The protection of residents from the hazards presented by the overland flowpaths.

(d) The interaction between the proposed stormwater solution and the groundwater beneath the site.

(e) The suitability of the site soils for disposing of stormwater to ground by soakage.

(f) The effect of the discharge from the site on the downstream environment, including the Little Waihi Drainage Scheme.

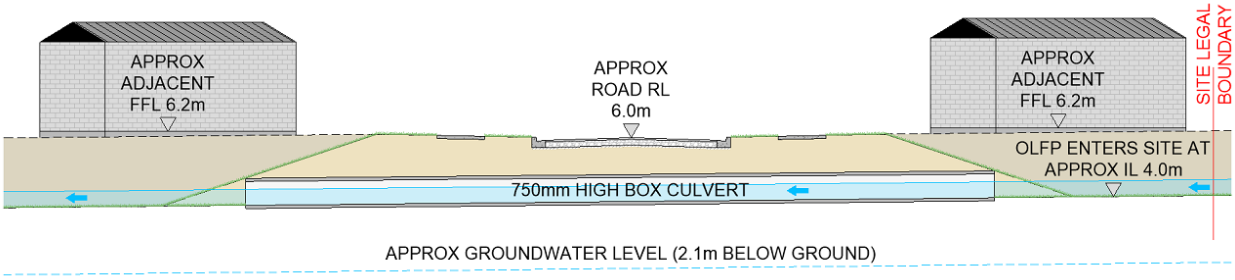
(g) The cumulative impacts of the additional stormwater volume generated and the infilling of the flood plain.

A response to each of these issues is below.

38. With regard to the stormwater management plan, I believe that the level of detail otherwise presented as part of this process is sufficient to demonstrate the stormwater serviceability of the site. As more detailed designs are developed in subsequent stages, a stormwater management plan can be developed accordingly.

39. With regard to the culverts required to convey Overland Flowpath 2 beneath roads, please refer to the image below showing how this culvert arrangement would function. The overland flowpath enters the site at approximately RL 4m, and the culverts would be set such that its invert is also at or around that level. There would be no need to cut down another 2.1m below the existing ground to install the pipe (as suggested by paragraph 15.30 of the Section 42A report), and therefore the pipe would not lie near or within groundwater. The adjacent land on which the lots would be situated is at more than RL 6m, and so would the roads that cross the overland flowpath. I concur with WBOPDC's

contention that a 1200mm pipe is appropriately sized for the flow rate in OLFP 2, but believe a box culvert with less height would be more suitable to allow more freedom of cover for the reticulation of other services over top of the culvert. My calculations suggest that a 3m wide by 0.75m high culvert would have the appropriate capacity while flowing at only half its height. When flowing full, the culvert can carry approximately 12m³/s, which is approximately three times the modelled flow rate in the 100-year 10-minute storm.



40. With regard to the protection of residents from the hazards associated with crossing or entering the overland flowpaths, all overland flowpaths are to be contained within either roads, ROW's, or vested stormwater reserves. As above, the overland flowpaths can be formed such that traversing them is not required to safely evacuate any part of the site. I don't agree with the statement that planting and physical barriers are not convincing as solutions, as that is common practice when forming overland flowpaths. The image below shows a similar situation in Papamoa, Tauranga, where an overland flow path is planted in a similar fashion to what is envisaged here.

41. With regard to the interaction between the proposed stormwater solutions and groundwater, I don't consider this issue to be of significance to the serviceability of the site. I have addressed the effect of groundwater on the culverts beneath the roads above, and a similar argument applies to the stormwater pond. The base of the pond can be set at or around the existing ground level or around RL 4m, well clear of the groundwater at around RL 2.5m – RL 3m. Bunds will need to be formed and fill placed to create the pond profile. Finally, with regard to the proposed soakage systems, the land on which dwellings will be constructed and soakage systems installed will be at

approximately RL 5.5m or higher, meaning that at least 2.5m of depth is available above the recorded groundwater level. I believe this is sufficient to give confidence at the Plan Change stage that appropriate systems can be installed. As per the example in the servicing report, shallow systems can be placed within even the smaller proposed lots.

42. With regard to the suitability of the site soils for disposing of stormwater to ground by soakage, I have consulted with CMW geotechnical engineers and their advice confirms that it is a reasonable assumption that the soakage characteristics of soils at adjacent sites are similar to those of the subject site. Site specific soakage testing will be a requirement at subsequent design stages, at which point the specifics of the systems can be confirmed.

43. With regard to the effect of the discharge from the site on the downstream environment, the modelling already provided in Lysaght's Engineering Servicing Report[7] confirms a reduction in discharge rates and volumes across almost all events. The modelling undertaken confirms that discharge volumes will be reduced in 15 of the 16 storms modelled (8 primary storms and 8 secondary storms). The exception is the 24-hour 10-year storm, where an additional 200m³ is predicted to be discharged (or an additional approximate 10% in that storm). On balance, the modelling suggests an improvement in the volume of runoff that will be sent to the Little Waihi Drainage Scheme. A 2D flood model of the entire flood plain (some 3,700 Ha in scale) has not been undertaken to analyse the effect of fill displacement, however numerical volume displacement calculations suggest an imperceptible effect will arise.

44. With regard to the cumulative effects of development and infilling in the floodplain that has not been modelled, in my opinion it wouldn't be feasible or useful to do so. The floodplain north of the site is so vast and contains many properties which means there are near infinite possibilities that could be

[7] Lysaght Engineering Servicing Report (Revision 7) dated 22 August 2024, Appendix C of Response to Further Information Request dated 30 August 2024.

considered for a model. Further, large scale development is unlikely to be feasible within the floodplain, as the land is too low-lying and has poor soils for development.

45. Minor developments (for example, the construction of individual dwellings) might be feasible, but they would likely have only imperceptible global effects on the functionality of the floodplain. Those small developments may induce localised effects such as those on small drainage channels or systems, but those needn't be considered in relation to this Plan Change application. Only elevated sites on the perimeter of the floodplain like this one could feasibly be developed and they will have negligible global impacts on the floodplain's functionality.

46. Therefore, I don't consider it necessary to require cumulative effects to be modelled when considering such a vast and low-lying floodplain as is present north of this site.

Comments on proposed rules

47. I have reviewed the Staging prerequisites in the Plan Change application and the latest updated set and can confirm that the stated prerequisites provide a logical and sequential order of infrastructure development, which will provide adequate reticulation for each stage of development.

Conclusion

48. The Plan Change 95 site can be readily serviced with infrastructure sufficient to meet Council's Development Code. The development earthworks will not create any offsite effects that would give rise to increased flooding during storm events up to and including 1% AEP events. Roads can be upgraded or constructed to meet the Development Code and any special requirements recommended by the traffic engineer and the geotechnical engineers. For

these reasons, I can support the Plan Change from an engineering perspective and consider the proposed planning frameworks to be appropriate.

Daniel Hight
24th October 2024