BEFORE INDEPENDENT HEARING COMMISSIONERS
APPOINTED BY THAMES COROMANDEL DISTRICT COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the hearing of submissions to Variation 3 to the Proposed Thames Coromandel District Plan (Taiwawe Catchment Structure Plan)

STATEMENT OF EVIDENCE OF PHILIP IAN KELSEY ON BEHALF OF HOT WATER BEACH (NZ) LIMITED

Dated 1 March 2021

INTRODUCTION

Qualifications and experience

1. My name is Philip Ian Kelsey. I am an Engineering Geologist and have been a Director of Earthtech Consulting Limited ("Earthtech") since 1989. My professional qualifications are BSc(Hons) in Geology from the University of Otago and MSc(Hons) in Engineering Geology from the University of Canterbury. I am currently a member of the following professional societies:

    - New Zealand Geological Society;
    - New Zealand Geotechnical Society;
    - New Zealand Hydrological Society; and
    - National Groundwater Association (USA).

2. I have been practising in the fields of geotechnical engineering and hydrogeology for the past 33 years. My relevant experience to the proposed Taiwawe Catchment Structure Plan includes geotechnical investigations associated with the following projects:

    - Kaimarama Rural Residential Subdivision, SH25, Whitianga – 138 hectares;
    - Kopu Residential and Commercial Subdivision, Ngati Maru Highway – 46 hectares; and
    - Te Arai Coastal Subdivision – 46 sites within 616 hectares.

3. I have also carried out more than 350 site investigations for rural-residential house sites which are of a similar scale to the 25 new house sites proposed at the Hot Water Beach site. These site investigations included the assessment of stability, foundation conditions, on-site wastewater and stormwater disposal.

Involvement in Project

4. I have been involved with the Hot Water Beach Structure Plan Project (**the Project**) since 2019 when Earthtech was engaged to provide a geotechnical assessment for the 38 hectare property. I prepared the Earthtech Geotechnical Assessment Report that is attached as **Appendix A.** This report is based on desktop review, field mapping and hand auger bores of land within the Project area.

5. Since the Report was prepared, the Project has been revised to a reduced number of sites, with defined building platform areas and roading as located on Attachment 1 (Overall Development Concept) prepared by Brown NZ Ltd.

6. This statement of evidence is prepared to address this revised layout and number of lots, which I have illustrated on my **Figures 1 and 2** attached.[1] I have also sighted the revised Structure Plan document as being produced by Mr Lawrence with his evidence, and am familiar with its content as it relates to the topics covered in this evidence.

Purpose and Scope of Evidence

7. My evidence describes the Project Area's ground and groundwater conditions and evaluates geotechnical constraints associated with the 25 new house sites as now proposed for the Structure Plan. On-site wastewater disposal options are also presented.

8. Stormwater disposal options for the project are outlined in evidence by Mr Mike Chapman.

Expert Witness Code of Conduct

9. I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note 2014. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Summary of Conclusions

10. From my geotechnical assessment, I consider the Structure Plan land suitable for the proposed 25 new house sites and associated accessway alignments.

11. Safe and stable building platforms exist for each of the house sites. Favourable stability conditions are provided by low slope angles, strong ground conditions and deep groundwater levels. In general, house sites have adequate setback distances from mapped landslides and potentially unstable moderately steep to steep slopes. The Structure Plan allows sites with inadequate setbacks to be shifted if required once further geotechnical investigations are carried out at the subdivision scheme plan stage.

[1] These figures draw on Figures 1.1 and 1.2 included within the Report, but with the revised road and lot layout overlaid. For the avoidance of doubt, the "building platform" areas shown on my Figures 1 and 2 are in the same locations as the "Defined Building Areas" shown on the Overall Development Concept plan prepared by Brown NZ Ltd.

12. Suitable options are available for on-site wastewater disposal. These options are not expected to result in adverse effects on either surface water or groundwater.

13. I consider that the existing District Plan along with the revised Structure Plan provisions adequately address geotechnical constraints to ensure that adverse environmental effects of relevance to my evidence are appropriately avoided, remedied or mitigated .

EXISTING ENVIRONMENT

Landforms

14. Existing landforms are presented in **Figure 1** and **Figure 2** attached to my evidence. Most of the 38.3 hectare property extends over northerly and north-westerly facing hill country which rises from RL 5m at the northern boundary to RL105m at the southern boundary. The hill country is crossed by Gully A and Gully B (as shown on Figures 1 and 2), that are incised to about 10m to 20m depth.

15. Outside of the gully areas, the majority of the ground is gently sloping (less than 15 degrees to the horizontal). Within the gullies, the slopes are moderately steep (15 degrees to 25 degrees) to steep (25 degrees to 35 degrees). Very steep slopes are limited to the headscarp areas of Landslide Ls3 and Landslide Ls4 also shown on Figures 1 and 2, and addressed further below.

16. Alluvial flats at about RL5m extend between the edge of the rolling hill country and the Taiwawe Stream.

17. From my fieldwork, the majority of the property is in pasture with regenerating bush within the gullies and steeper slope areas. An old airstrip is located adjacent to the eastern site boundary. Associated with the airstrip are limited areas of fill.

Site Investigations

18. I have characterised the sites ground and groundwater conditions from

    (a) Field mapping; and

    (b) Eleven hand auger bores up to 3m depth.

19. The engineering geological mapping and bore locations are presented in **Figure 1** and **Figure 2.** Also shown are the proposed house sites (building platform areas) and accessways associated with the revised Structure Plan.

20. I consider that the investigations outlined above are comprehensive in terms of providing sufficient information to assess the geotechnical constraints for the proposed Structure Plan.

Ground Conditions

21. Detailed descriptions of ground conditions are presented in Appendix A. I wish to summarise these as follows:

(a) Rolling Hill Country

(i) Topsoil. 0.1m to 0.3m thick.

(ii) Brown Ash. Forming an extensive mantle at the ground surface over andesite geology between 1.5m and greater than 3m thick. Consisting of high strength very stiff to hard clays and silts with a well-oxidised texture indicating favourable drainage.

(iii) Residual Andesite Soil. Extensive high strength very stiff to hard sandy clays and silts with some gravelly clay.

(iv) Andesite Bedrock.

(v) Colluvium. Moderate strength firm to stiff clay, silt and gravel associated with landslide and soil creep areas.

(vi) Non-Engineered Fill. Moderate strength firm to stiff organic silt within sidling fill areas on the airstrip.

(b) Stream Flats

(i) Alluvium. Young alluvium consisting of firm silt and clay overlying stronger older alluvium consisting of stiff to very stiff soils.

Groundwater Conditions

22. All of the hand auger bores on the elevated hill country were dry, indicating a depth to groundwater of greater than 3m. For the hill country area, I expect the groundwater table is at greater than 10m depth due to elevation and permeable geology.

23. On the stream flats, I expect groundwater to be within 1m of the ground surface from the hand auger bores in this area (the bore at HA109 encountered groundwater at 0.7m depth).

GEOTECHNICAL ASSESSMENT

Slope Stability

24. During the site mapping, I identified five landslides which are shown and labelled Ls1 to Ls5 in **Figure 1** and **Figure 2**.

25. Landslides Ls1, Ls2 and Ls5 are shallow (estimated 2m to 6m depth) features involving instability of the brown ash and residual andesite soils located on moderately steep to steep ground which is restricted in extent. Landslide Ls1 and Landslide Ls2 are overall inactive with a well-established bush cover. Landslide Ls5 is active, located on open farmland.

26. Landslide Ls3 and Landslide Ls4 are deep-seated (estimated 10m to 20m depth) involving bedrock instability. Landslide Ls3 is inactive, and Landslide Ls4 is active.

27. From my viewing of historical aerial photographs between 1944 and 2010, most of the mapped landslides can be clearly seen. The photographs show that the regenerating bush cover within the gully and steeper slope areas have significantly improved stability.

28. For the preliminary assessment presented in Earthtech (2019), I have recommended the following conservative building setback distances:

    (a) Greater or equal to 10m setback from the crests of moderately steep to steep slopes (slopes steeper than 15 degrees) and shallow landslide areas (Landslides Ls1, Ls2 and Ls5); and

    (b) Greater or equal to 30m setback from the headscarp crests of Landslide Ls3 and Landslide Ls4.

29. The attached **Figure 1** and **Figure 2** show that all proposed house sites (building platform areas) have adequate setback distances apart from house sites 14, 15, and 16. . The Structure Plan allows these three sites to be moved if required once further geotechnical investigations are carried out at the subdivision scheme plan stage.

30. My mapping also identified shallow soil creep (0.5m to 1.5m depth) on slopes greater than 18 degrees. Adequate setbacks from soil creep areas have been incorporated in the above recommendations.

31. With the above revision, I consider that the 25 proposed house sites have acceptable stability on the basis of being located on:

(a) Gently sloping ground (5 degrees to 15 degrees) outside of landslide and soil creep areas; or

(b) Ridge crests; or

(c) Side spur crests; and

(d) Strong soils associated with the brown ash and residual andesite geology combined with deep groundwater conditions.

32. Specific investigations and further analysis will be required at both subdivision and building consent stages to confirm stability and verify building setbacks from steeper sloping areas.

33. Protection of existing bush in the vicinity of Landslides Ls1 and Ls2 together with landscape and conservation planting in the vicinity of Ls3 and Ls4 will improve stability conditions in these areas.

House Foundations

34. In the elevated hill country, the brown ash and residual andesite soils consist of high strength very stiff to hard soils. These soils will provide suitable ground conditions for conventional house foundations in terms of both bearing capacity and settlement.

35. On the stream terrace, house site 25 is expected to be underlain by firm to stiff soil based on near-by bores. From the soil strength profile observed, a "rib-raft" foundation or equivalent could be considered.

36. **Figure 1** shows that house site 5 is located on the edge of a fill area. For this building platform, the fill could either be undercut or the house site moved as allowed for by the revised Structure Plan.

Wastewater Disposal

37. On-site wastewater disposal is proposed for each dwelling. The Structure Plan requires secondary effluent treatment with design following TP58 (ARC, 2004) or AS/NZS 1547.

38. My assessment of the required effluent disposal areas in terms of both TP58 and AS/NZS 1547 is as follows:

(a) From Table 1 of the revised Structure Plan, water demand = 5 people @ 300 litres per person per day = 1.5m³ per day wastewater.

(b) Ground conditions, 0.2m topsoil over brown ash – Table 5.1, TP58, Soil Category 5 – silty clay loam – moderate to slow drainage and Category 4 (AS/NZS 1547).

(c) Propose secondary treatment with disposal via pressure subsurface drip irrigation at 100mm depth within topsoil. Drip lines to be 1m apart.

(d) Effluent design and loading rate of 3mm per day to 4mm per day (Category 5 soils) from Table 9.2 TP58 and 3.5mm per day (Category 4 soils from Table M1 AS/NZS 1547).

(e) Wastewater disposal area

$$\frac{1.5m^3/d}{3.5mm/d} = 430m^2$$

(f) Wastewater reserve area – at 50% disposal area due to secondary treatment, proposed 215m².

(g) Total disposal area = 645m².

39. The above shows a 645m² area requirement for each house site. For each site shown in **Figure 1** and **Figure 2,** sufficient area is available for on-site wastewater disposal.

40. With the exception of site 25, depths to groundwater are greater than TP58 minimum requirements at 0.9m for secondary treated effluent.

41. Potential water quality effects of wastewater disposal are addressed by:

(a) Secondary treatment of wastewater;

(b) Plant uptake of nutrients; and

(c) Renovation of effluent within the topsoil and partially saturated soil above the groundwater table.

42. Disposal areas will be located on gently sloping ground to avoid slope instability effects.

43. Further investigations and analysis will be required at the subdivision consenting stage to confirm specific sizing and location of wastewater disposal areas. Specific assessment is also required at house site 25 located on the stream flats.

44. The Waikato Regional Plan requires a 2,500m² minimum lot size to meet permitted activity criteria. The 2,500m² lot size will be met by the low-density subdivision proposed by the Structure Plan.

EARTHWORKS

45. The proposed house sites and the majority of the accessway alignments are located on gently sloping ground which minimises earthworks. Some ground retention will be required where the accessways cross steeper ground.

46. I consider the site soils are suitable for structural fill with reworking and possibly conditioning.

PLANNERS REPORT

47. I have read parts of the TCDC Section 42A Report that relates to my evidence. I wish to refer to geotechnical queries raised in the following evidence.

48. Planners Report, Paragraph 147. I do not consider that rainfall modelling is required for the assessment of slope stability or wastewater disposal. Rainfall variability, and in particular the effects of high-intensity rainfall events, are already included in my assessment of slope stability and wastewater disposal.

49. Planners Report, Paragraph 155. My Geotechnical Assessment Report recommended a 15 metre minimum setback from the Taiwawe Stream banks to avoid local instability. The attached Figures 1 and 2 show that all building sites are setback greater than 40m from the stream bank slopes. With the defined building sites no additional Structure Plan additional rule is required.

50. Planners Report, Paragraph 165. The geotechnical assessment outlined in my evidence is based on a combination of desktop review, engineering geological mapping and eleven hand auger bores. Site permeability testing is not considered to be required at the Structure Plan stage. My evidence above provides a specific assessment of wastewater disposal areas with appropriate recommendations.

51. Planners Report, Paragraph 167. Paragraphs 37 to 44 of my evidence provides an assessment of the required wastewater disposal areas in terms of AS/NZS 1547:2012.

CONCLUSIONS AND RECOMMENDATIONS

52. Based on the geotechnical investigations carried out at the site, I consider that the land is suitable for the proposed 25 new house sites and associated accessways.

53. Extensive gently sloping areas are available for the development of stable house platforms and accessways without the requirement for extensive earthworks.

54. Conventional options are available for on-site wastewater disposal. These options are not expected to result in adverse effects on either surface water or groundwater.

55. I consider that the existing District Plan alongside the revised Structure Plan provisions adequately address geotechnical constraints to ensure that adverse environmental effects of relevance to my evidence are appropriately avoided, remedied or mitigated .

Philip Kelsey
March 2021

REFERENCES

Auckland Regional Council (2004)	On-site Wastewater System: Design and Management Manual. Technical Publication 58. Auckland. New Zealand.
AS/ANZ 1547 (2012)	On-site Domestic Wastewater Management. Australian/New Zealand Standards. Standards Australia.
Earthtech (2019)	Geotechnical Assessment for Structure Plan. Rural Residential Subdivision. 790C Hot Water Beach Road, Whitianga. Prepared for Hot Water Beach NZ Limited. Ref R3352-2 dated 2 April 2019.

APPENDIX A

Earthtech (2019) Geotechnical Assessment for Structure Plan. Rural Residential Subdivision. 790C Hot Water Beach Road, Whitianga. Prepared for Hot Water Beach NZ Limited. Ref R3352-2 dated 2 April 2019.