BEFORE THE INDEPENDENT HEARING PANEL ON PROPOSED PRIVATE PLAN CHANGE 13 TO THE OPERATIVE HAMILTON CITY DISTRICT PLAN

IN THE MATTER of the Resource management Act 1991 (the Act)

AND

IN THE MATTER of proposed Private Plan Change 13 to the Hamilton City District Plan

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Evidence of Aine Colson on behalf of the Waikato Racing Club Incorporated
Dated 26 July 2023

MAY IT PLEASE THE INDEPENDENT HEARING PANEL

INTRODUCTION

Qualifications and Experience

1. My name is Aine Colson

2. I am an Associate Geotechnical Engineer with CMW Geosciences, a chartered member of Engineering New Zealand, and a member of the New Zealand Geotechnical Society. I have 13 years of geotechnical engineering experience both internationally and in New Zealand, which has been in the areas of land, building, and infrastructure development, over variable terrain and geological conditions. Areas of particular experience include site investigations, geological modelling, retaining structures, geotechnical advice for buildings, slope stability, and soft soil engineering.

3. I am familiar with the application site and the surrounding locality. I have read the relevant parts of the application; and the Section 42A Report.

Involvement in Proposed Plan Change 13

4. I have been engaged by Bloxam Burnett and Olliver Limited "BBO" and Waikato Racing Club Incorporated (''WRCl'') to prepare evidence for Proposed Plan Change 13 ("PC13"). I was the author of the Geotechnical Investigation Report (GIR) associated with the PC13 request.[1]

CODE OF CONDUCT

5. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice note (2023) and I agree to comply with it. In that regard, I confirm that this evidence is written

[1] (GIR) (ref. HAM2022-0030AB Rev 1 dated 20 July 2022).

within my experience. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SUMMARY OF EVIDENCE

6. The Geological Investigation Report ("GIR") presents the results of geotechnical investigations and a geohazards assessment of the WRCI property located at the Te Rapa Racecourse on Ken Brown Drive, Te Rapa, Hamilton ("the Site").

7. The Site has an area of approximately 6.5ha and is relatively flat (RL 32.5m to RL 35m). It is underlain by Hinuera Formation alluvium. The relict Te Rapa Channel, which is a paleo river channel from when the Waikato River was a braided system, extends southeast to northwest through the centre of the Site (refer to Paragraph 13 and Figure 2).

8. The Precinct Plan for the Site depicts a residential development with a mix of housing types possibly including detached dwellings, two and three storey duplexes, terraced housing, and three storey apartment blocks; and associated roads, laneways, footpaths, and open space; with a stormwater treatment/attenuation pond just to the east of the development area. I understand that the PC13 provisions include a height limit of 15m, which would allow up to 4 storey development.

9. I consider that the Site is suitable for the level of development that is facilitated by PC13 subject to my geohazards assessment and geotechnical recommendations (summarised below) being addressed at the subdivision consent and detailed design stage, and later when building consent is obtained.

PURPOSE AND SCOPE OF EVIDENCE

10. In my evidence, I:

(a) provide a summary of my key conclusions in the summary of evidence;

(b) provide an update on incorporation of changes to the National Seismic Hazard Model into liquefaction assessment guidance;

(c) summarise the relevant aspects of PC13 with respect to geotechnical engineering;

(d) set out an assessment of PC13 with respect to anticipated geotechnical effects;

(e) set out my recommendations that should be addressed at the detailed design stage through the resource consent and building consent processes;

(f) respond to the s42A report; and

(g) set out my conclusion.

NATIONAL SEISMIC HAZARD MODEL

11. The proposed update to the National Seismic Hazard Model ("NSHM") provides an estimate of the likelihood and strength of earthquake ground shaking at any given site in New Zealand and considers how different parts of the country might behave in the event of large magnitude earthquakes. The NSHM is used to inform technical standards for earthquake engineering design as well as providing critical information for earthquake risk.

12. The proposed changes to the NSHM, as it relates to the Site, are expected to reduce the peak ground acceleration, which is the critical input for liquefaction analysis. The design earthquake magnitude may also change slightly, but this is not a significant input. The outcome of the NHSM update will be to reduce the liquefaction risk for the Site, compared to the risk described in the GIR. We are expecting the Ministry of Business,

Innovation and Employment ("MBIE") geotechnical guidelines to be revised later this year to incorporate the updated NHSM. We cannot currently base our design on the ground shaking hazard from the updated NSHM but expect to be able to do so at the consenting stage.

CONTEXT AND BACKGROUND

Site Description

13. The Site comprises an area of approximately 6.5ha and is shown below in Figure 1.

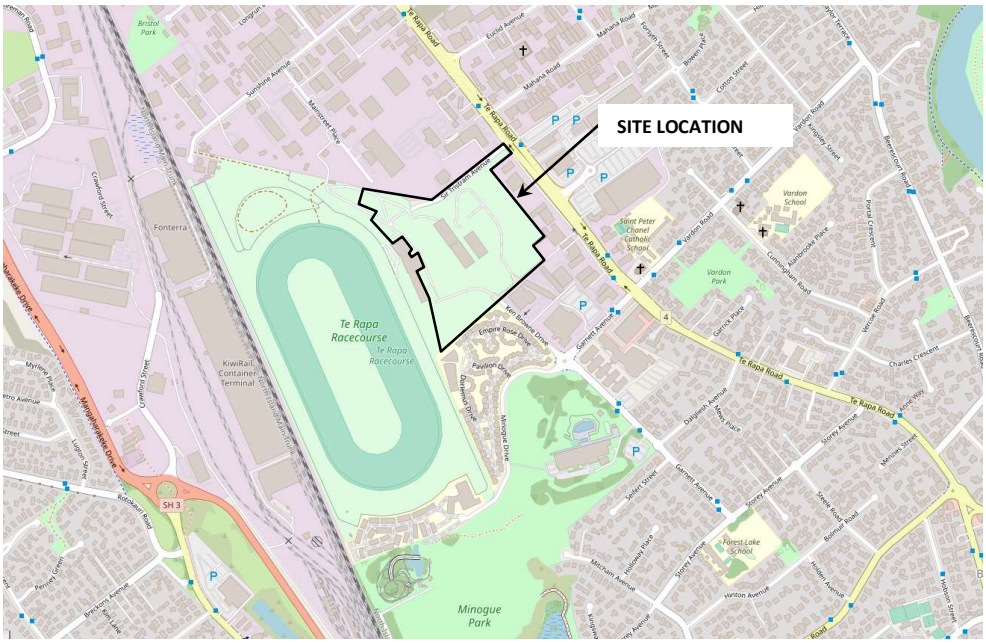

Figure 1: Site Location Plan (OpenStreetMap)

14. The current general landform, together with associated features located within and adjacent to the Site, are presented in the CMW Geosciences site plan (Figure 2). The Site is relatively flat (RL 32.5m to RL 35m) and underlain by Hinuera Formation alluvium. The relict Te Rapa Channel, which is a paleo river channel from when the Waikato River was a braided system, extends southeast to northwest through the centre of the Site. Weak organic material was encountered within the upper 1.0m to 1.5m of CPT02 and CPT04, which may be attributed to the backfilling of the Te

Rapa Channel at those locations. Other areas of non-engineered fill may be present due to the Site's history.

15. Groundwater across the Site was present at 1.5m to 2.8m below ground level during the investigation in late Autumn conditions in May 2017.

16. The Site is bound to the northwest by Sir Tristram Avenue; to the northeast by industrial/commercial properties; to the southeast by industrial/commercial properties between Te Rapa Road and Ken Browne Drive and a recent residential development, on what was previously WRCI land, between Ken Browne Drive and the Te Rapa Race Course; and to the southwest by the Te Rapa Racecourse grandstand, club offices, and events centre, and carpark. The Site currently contains three horse stable buildings, grassed paddocks used for horse grazing, metalled tracks, a 2m high soil stockpile in the northern corner, and a bund of stockpiled soil in the southwest corner next to the racing track.

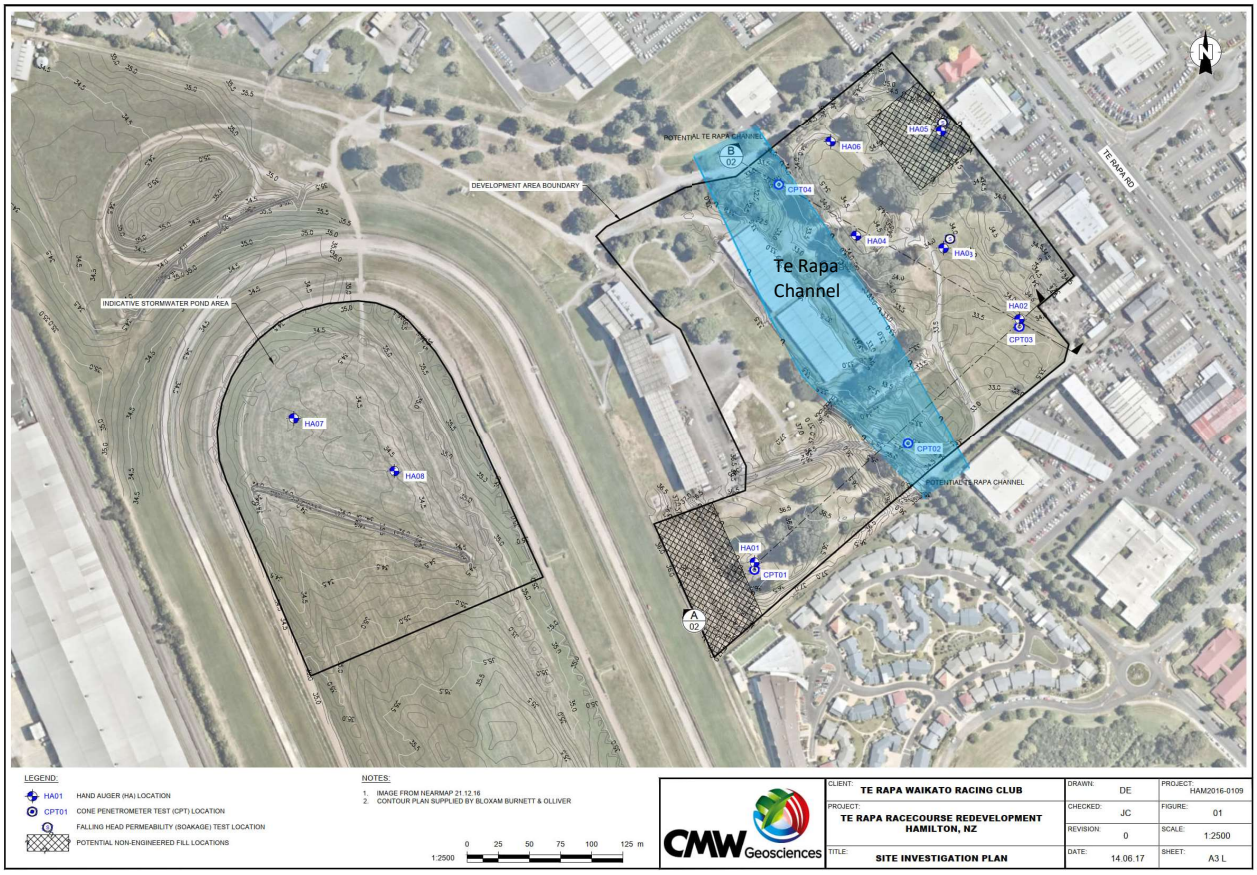

Figure 2: Site Plan with Geotechnical Test Locations

17. The Kerepehi Fault is the nearest known active fault and is located approximately 38km northeast of the Site. Therefore, the risk of fault rupture affecting the Site is very low.

OVERVIEW OF THE PLAN CHANGE

18. The Precinct Plan for the Site (Figure 3) depicts a residential development with a mix of housing types possibly including detached dwellings, two and three storey duplexes, terraced housing, and three storey apartment blocks; and associated roads, laneways, footpaths, and open space; with a stormwater treatment/attenuation pond just to the east of the development area. I understand that the PC13 provisions include a height limit of 15m, which would allow up to 4 storey development.

Figure 3: Structure Plan

RECOMMENDATIONS FOR SITE WORKS

19. I set out below my various conclusions and recommendations that should be considered in the subsequent consenting stages (subdivision and building consent):

Seismic Site Subsoil Category

(a) Based on the geological units encountered beneath the Site, the seismic site subsoil category is assessed as being Class D (deep soil site) in accordance with NZS1170.5.

Liquefaction Assessment

(b) Liquefaction settlements of 55mm to 105mm could be expected under the Ultimate Limit State (ULS) seismic event for the Site. Differential settlements should be taken across the width of the relevant structure.

(c) Seismic Cone Penetration tests (SCPTs) should be carried out as part of the detailed design process to evaluate if any soil ageing factors can be applied to the liquefaction analyses, which could reduce the predicted liquefaction induced settlements.

(d) Undertake assessment in terms of the NSHM, if it has been incorporated into MBIE modules by detailed design stage.

(e) If applicable, undertake testing to obtain the average shear wave velocity within the top 30mbgl (Vs30), which is an input for determining design PGAs from the new NSHM.

(f) Liquefaction assessment should be updated as appropriate based on the findings of additional testing and the status of the NSHM. Both use of ageing factors and/or the NSHM would be less onerous in terms of the predicted liquefaction settlements and may allow less onerous foundation requirements.

Slope Stability

(g) As the Site is flat to gently sloping, we qualitatively assessed that there is an overall low risk of slope instability for the proposed development. Depending on the final design for the development, quantitative slope stability analyses may need to be undertaken at building consent stage for any localised cut or fill batters.

Load Induced Settlement

(h) Load induced settlements are estimated to be in the order of 5mm to 25mm beneath the centre of 10m x 20m raft with a footing depth of 0.5m and net applied working pressures of 10kPa to 20kPa.

(i) Total settlement should be within acceptable limits for the foundation cases above providing that any soft soils are undercut and replaced with engineered fill.

(j) Settlement across the Site is expected to be relatively uniform and differential settlement is expected to be below the limit set by the New Zealand Building Code.

Bearing Capacity

(k) Where present, weak silty/organic soils within the upper 1.5m should be undercut and replaced with engineered fill to provide adequate bearing capacity avoid excessive load induced settlements. The undercut material should be removed from site or used as landscape fill onsite. The extent of the soft soils should be confirmed by further investigation at the resource consent stage.

(l) Subject to the natural silt soils being managed appropriately during construction, a geotechnical ultimate bearing capacity of 300kPa may be assumed for the raft foundation beams, provided perimeter and internal beams do not exceed 500mm in the short axis.

(m) The results of our investigation suggest there is the potential for isolated pockets of weak soil to exist that will require local over-excavation and compaction to densify the in-situ materials. This should be verified during routine foundation observations.

Strength Reduction Factors

(n) As required by section B1/VM4[2] of the New Zealand Building Code Handbook, the following strength reduction factors must be applied to all recommended geotechnical ultimate soil capacities in conjunction with their use in factored design load cases: 0.8 for load combinations involving earthquake overstrength; 0.5 for all other load combinations.

Foundations

(o) Based on the liquefaction and static load induced settlement, and bearing capacity analyses, raft foundations should be appropriate to support the proposed 1-storey to 4-storey high buildings.

(p) The GIR considered 1-storey to 3-storey buildings. We now understand that buildings up 4-storey buildings may potentially be considered for the Site. We have assessed that raft foundations for 4-storey buildings would require Specific Engineering Design. This is because the estimated static settlements of 10mm to 30mm (based on the assumptions stated in the GIR) exceed the limit of 25mm for using B1/VM4[2] as the basis for design verification. As for 1-storey to 3-storey building, shallow ground improvement, comprising geogrid reinforced gravel rafts, may be needed to mitigate liquefaction induced settlement.

(q) With respect to the MBIE guidance, raft foundations should be designed based on a TC2 solution adopting the total and differential

[2] Ministry of Business, Innovation and Employment (2019) *Acceptable Solutions and Verification Methods for NZ Building Code Clause B1 Structure,* B1/VM4, Amendment 19

settlements stated above. For areas of the Site where liquefaction induced settlement is predicted to be greater than 100mm (currently limited to the area of CPT02), TC2/TC3 hybrid foundations comprising a TC2 raft plus an underlying geogrid reinforced gravel raft will be required. The extent of this zone will require further CPT investigation to be carried out as part of the detailed design process.

Earthworks

(r) All earthworks should be carried out in accordance with the requirements of NZS4404:2010 (Land Development and Subdivision Infrastructure) and NZS4431:1989 (Code of Practice for Earth Fill for Residential Development), Hamilton City Council Development Manual and under the guidance of a Chartered Professional Geotechnical Engineer.

(s) The natural near surface soils may be used for cut to fill earthworks across the Site, with appropriate moisture conditioning.

(t) Hinuera Formation silts are expected be encountered at design subgrade level across the site and are susceptible to strength loss when remoulded, particularly when they are wet. This needs to be taken into account during bulk earthworks.

(u) Topsoil or uncontrolled fill containing organics is not suitable for use in engineered fills.

(v) Further investigation will need to be undertaken to determine the suitability of the stockpiled soil within the Site for use as engineered fill. However, in any case it may be used as landscape fill in reserve areas or be removed from site.

Stormwater Disposal

(w) Conventional soakage trenches or soakholes are considered a practical solution for the disposal of stormwater within the proposed building development areas.

(x) Detailed assessment of stormwater design volumes, stormwater pond design, soakage trench locations and specific design will be required at the engineering plan approval stage and prior to any building development. The risk of lateral spread into the stormwater pond during the design seismic events should be assessed at the Resource Consent stage, once there is confirmation of how deep the pond will be.

20. The above recommendations represent good engineering practices that are commonly applied for land development and are considered suitable to address the natural hazard risks for the Site.

21. In my experience, these recommendations do not need to be incorporated into PC13 provisions because they are better suited as conditions applied at the resource consent stage because they are based on specific details most relevant for that development stage.

REPONSE TO SUBMISSIONS RAISED

22. The submissions to PC13 did not raise any geotechnical issues requiring response.

RESPONSE TO THE SECTION 42A REPORT

23. The s42A report does not raise any issues on geotechnical matters that require a response from me.

CONCLUSION

24. I consider that the Site is suitable for the level of development that is facilitated by PC13 subject to my geohazards assessment and geotechnical recommendations (summarised above) being addressed at the subdivision consent and detailed design stage, and later when building consent is obtained.

Aine Colson
26 July 2023