Before WBOPDC District Plan Hearings Committee in Tauranga

In the Matter of	the Resource Mangement Act 1991
and	
In the Matter of	a private plan change (Plan Change 94) to establish the Washer Road Business Park (Ref A4524970).
And	submissions received on Plan Change 94
Application By	David Marshall

Statement of Evidence of

Robert Benjamin Telford

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Qualifications and Experience

1. My full name is Robert Benjamin Telford. I am an Associate Engineering Geologist with CMW Geosciences NZ Limited Partnership (CMW).

2. I have worked as an engineering geologist with several professional consultancies since 2003. I have experience with numerous residential and commercial developments, having worked for extended periods in Auckland and Christchurch, and have been based in the Bay of Plenty since 2012.

3. I am familiar with the requirements of the NZ Building Code and Resource Management Act as they relate to the geotechnical engineering of large and small projects. I have also provided specialist advice for projects being assessed under the Bay of Plenty Regional Council Regional Policy Statement (RPS) including the Te Tumu residential development and Stage 4 of the Tauriko Business Estate.

4. I hold a degree of Bachelor of Science from The University of Auckland (2000) and am a Tauranga City Council and Western Bay of Plenty District Council accredited Category 1 Geo-Professional.

Code of Conduct

5. I have read the Code of Conduct for Expert Witnesses issued by the Environment Court in 2014. I confirm that my evidence and professional engagement and involvement with this application is in accordance with the Code of Conduct and my duties and obligations as a professional witness. With specific regard to my evidence, the matters which I address are within my area of expertise and I have not omitted any material facts that might alter or detract from the professional opinions that I express.

Scope of Evidence

6. The evidence I present is specific to the geotechnical investigations and analyses undertaken by CMW for this development, as presented in our Geotechnical Investigation Report (GIR) dated 31 May 2022. I was not an author of this report but I have reviewed the results and recommendations

presented in it and am familiar with the geological conditions of the subject site and surrounding area, as well as the analyses methods and theories used for our assessment.

7. The report includes analyses of the geotechnical hazards affecting the site which include static (i.e. load-induced) settlement, soil bearing capacity for foundation design and slope stability. I will summarise these results, before focussing on the specific liquefaction risk and possible effects to the gas main that runs adjacent to the site's western boundary, as we understand these have been specifically requested for this hearing.

8. The CMW report was initially intended to support a resource consent application. We later revised the report to include a brief discussion of the implications of the Regional Policy Statement, but we have not updated our calculations to reflect the larger earthquake magnitudes required by the RPS.

Project Understanding

9. Although detailed plans of the proposed development were not available at the time of our analyses and site assessment, the Structure Plan to guide future development was available and is appended to our report. We understand the project will consist of an industrial subdivision similar to the existing developments in the area. We envisage that the likely buildings will comprise large portal frame warehouse structures with shallow pad foundations.

10. We further understand that, due to flooding risk, the northern and eastern portion of the site will be filled by between 0.5m and 1.0m to raise finished ground levels. Future buildings will therefore found on either natural in-situ surface alluvial soils or on engineered fill.

11. Below the surface soils, the geological materials consist of variable Holocene-aged alluvial deposits (generally loose or relatively soft interbedded sands and silts) and Pleistocene-aged reworked deposits (medium dense to dense sands) which are locally known as the Matua Subgroup.

12. Groundwater has been measured at between 2.1m and 5.1m below current ground levels.

13. The proposed development area is bound to the east by the Ohineangaanga Stream channel which forms an approximately 5m deep incised gully and steep slope. The western site area contains a gas main and easement which runs approximately parallel to Washer Road.

Summary of Geotechnical Analyses

14. The GIR assessed that the alluvial soils within the upper 10m of the soil profile may experience significant static settlements due to earthworks and building loads. To mitigate this risk, we recommended that the development area be surcharged with temporary fill embankments. Surcharging works by over-consolidating the soft natural soils thereby inducing settlement before buildings are constructed and the surcharge is removed. Provided the surcharges at this site are appropriately designed and monitored, there would be a low risk of excessive static settlements affecting future buildings or infrastructure within the development.

15. The potential for slope instability along the eastern stream bank is assessed in the report. Calculations by CMW indicate that the factors of safety within 10m of this bank are less than commonly accepted for commercial development, although the factors of safety do not indicate a high likelihood of slope failure. We recommend that future development is set back at least 10m from the crest of the stream bank. At this distance, there is a low risk that buildings and infrastructure would be affected by instability.

16. The near-surface natural soils which underlie the site are of relatively low strength. The GIR recommends that a reduced geotechnical bearing capacity is adopted for buildings located on these natural soils. This does not preclude the use of shallow foundations on the site, but may require these foundations to be larger than standard or to use specifically designed ‘raft’ type systems. Buildings supported on engineered fill, including sites where the natural soils are excavated and replaced with engineered material, will likely be suitable for standard shallow foundations provided this is confirmed by a geotechnical engineer during the design process.

Liquefaction Risk

17. The analyses presented in our GIR indicate that there is a high likelihood of liquefaction within the Holocene-aged alluvial deposits during a 1/500 year earthquake (i.e. with a peak ground acceleration PGA = 0.26g). Estimated vertical 'free field' settlements due to this liquefaction are between approximately 150mm and 370mm.

18. With the vertical settlements described in the report, there is a significant risk that buildings in this area may be 'functionally compromised' in a 1/500 year earthquake or greater. However, the RPS allows for a percentage of buildings to be compromised without triggering a 'medium' or 'high' risk rating.

19. As noted in our GIR, the depth of expected liquefaction is between 4.7m and 9.7m below current ground levels. Reference to Ishihara (1985)[1] suggests a non-liquefiable crust of at least 4.5m is adequate to prevent liquefaction induced ground damage for the design (1/500 year) earthquake. The potential for any surface manifestation of liquefaction such as sand boils or ground cracking across the site in this event is therefore assessed as being 'low'.

20. I note that the analyses presented in our report were in accordance with the Ministry of Business, Innovation and Employment (MBIE) guidelines which were current at the time of our investigation. These guidelines were updated in late 2021. Based on an initial review of the calculations, and referring to the current standards, I consider that the settlement values presented in the GIR may be conservative and may be over-stating the risk due to liquefaction-induced settlement as observed at the ground surface. This would need to be confirmed during detailed design.

21. It is expected that large span portal frame industrial buildings can be designed to accommodate the magnitude of predicted liquefaction induced settlements without suffering structural collapse. The specific design will require further investigation, analysis and appropriate design of the building foundations and structure at the detailed design stage. Subject to this design, I expect it would be possible to achieve a 'low' risk rating for liquefaction damage at this site as defined in the RPS.

[1] Ishihara, K., (1985) "Stability of Natural Deposits During Earthquakes," Proc. Of the Eleventh International Conference on Soil Mechanics and Foundation Engineering, San Francisco, 12- 16th August 1985, Vol. 1, Theme Lectures Conferences, pp321- 376.

22. Our report also included computer modelling of the Ohineangaanga Stream channel under seismic loads to assess the effect of liquefaction on this slope. The calculations indicate that the factor of safety of the slope would be less than 1.0 under seismic loading if the deeper soils beneath the site liquefied. Some lateral ground movement would therefore be expected in this area. However, the horizontal ground displacements the design earthquake are calculated to be less than 10mm, and the risk of adverse effects to the site due to lateral spreading is therefore assessed as 'low'.

23. As previously mentioned, the report includes the recommendation that buildings and infrastructure be set back from the crest of this slope due to the static (i.e. non-earthquake) stability results. This setback distance will further reduce the likelihood of damage due to liquefaction induced slope movement.

Effect on Gas Main

24. The GIR also assessed the potential for adverse settlement downdrag effects on the Firstgas gas main and easement due to the surcharging. Settlements induced by surcharge embankments generally affect ground for some metres beyond the toe of the embankment. As a preliminary guide, and based on previous monitoring results over similar ground conditions, a nominal buffer distance of 10m to 15m from existing service pipes to the toe of fill embankments is considered sufficient to mitigate associated settlement risks to buried services.

25. The specific setback distance for this site would be confirmed during the resource consent process and/or detailed design of earthworks and buildings. I would expect that this will include installation of monitoring points at intervals along the easement which would be surveyed regularly while the surcharge is in place to ensure that the gas main is not affected. With appropriate analyses and monitoring, the risk of damage to the gas main as a result of static settlement beneath the surcharge is considered to be 'low'.

26. Regarding road crossings or other infrastructure to be placed within the Firstgas easement, I understand that Firstgas have indicated that carparks, roads, or other buried services may be permissible subject to detailed design and review. I consider that this is appropriate and would expect this to be carried out as part of the detailed design of the development.

27. If necessary, options to mitigate effects to the gas main would include installing sheet piles in key areas to isolate the pipeline from ground settlement or supporting structures near the pipe on deep piled foundations. This could include road crossings, which may be designed as ground-level ‘bridges’ spanning across the zone of influence of the pipe and supported on specifically designed piles if required.

Conclusion

28. In conclusion, specific geotechnical inputs will be required during detailed design to manage static settlements (via surcharging) and to confirm soil bearing capacities and foundation dimensions for future buildings once earthworks have been completed. Buildings and infrastructure should be set back 10m from the eastern stream bank due to low slope stability factors of safety in this area.

29. Assuming the above works are carried out, and based on the analyses provided in our geotechnical report together with my understanding of the local ground conditions, the geotechnical conditions within the site are generally appropriate for the proposed development.

30. I expect that it will be possible to design the proposed development such that it achieves a ‘low’ risk rating under the terms of the RPS due to liquefaction following the design earthquake or larger.

31. I also consider that it would be possible to either locate buildings and other loads sufficiently far from the gas main and/or to engineer services or road crossings above the pipeline such that the pipe would be unlikely to be adversely affected by the proposed development.

27 June 2022

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