BEFORE INDEPENDENT HEARING COMMISSIONERS
APPOINTED BY THE HAMILTON CITY COUNCIL

IN THE MATTER	of the Resource Management Act 1991 (**Act**)
AND	
IN THE MATTER	of an application for subdivision and land use consent for the Amberfield Development pursuant to the Act.
APPLICANT	Weston Lea Limited
CONSENT AUTHORITY	Hamilton City Council

EVIDENCE-IN-CHIEF OF PAUL JAMES FLETCHER FOR WESTON LEA LIMITED

Dated: 12 April 2019

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SUMMARY OF EVIDENCE

1. My name is Paul James Fletcher and I am an Associate Geotechnical Engineer with ENGEO Limited. I summarise my evidence, according to the key headings in this statement, as follows:

Slope Stability *(Page 6)*

(a) ENGEO has undertaken a detailed geotechnical investigation of the subject site involving Rotary Core Boreholes, CPT and sCPT testing, test pits and hand auger boreholes.

(b) This information has been used to evaluate the stability of the existing landforms and also to assess the stability of the proposed landforms.

(c) Earthworks on site will typically act to cut down terraces and reduce the existing slope gradients between terraces to create a broad gentle slope from west to east.

(d) On the basis of the investigation undertaken to date, I consider that the proposed development will generally increase the stability of the site and that the proposed residential lots will be adequately protected against slope instability in accordance with Section 106 of the Resource Management Act 1991.

(e) Specific design zones have been applied to areas of steeper site contours adjacent to the Waikato River. These areas will be reviewed and revised at detailed engineering design stage, as noted in the Section 42A report prepared by Hamilton City Council.

(f) Any development within the specific design zones will address the key geotechnical constraints as detailed in section 14.2 of the ENGEO Geotechnical Investigation Report for this site. This work will be undertaken at detailed design stage prior to the start of earthworks onsite. This includes pathways and other amenities to be provided within the Waikato Riverbank margin, and Gully Hazard Area for walkways and cycle paths.

Liquefaction and Lateral Spread *(Page 7)*

(g) Liquefaction under seismic (earthquake) loading has been investigated and assessed to a level considered suitable for a resource consent i.e. assessing the suitability of the site for development, although it is acknowledged that additional work will be required as part of the detailed design of this development.

(h) Soil liquefaction can manifest as settlement of the ground surface following an earthquake, and as lateral spread.

(i) Analysis undertaken as part of the Geotechnical Investigation of this site indicates that the risk of liquefaction induced hazard is low to moderate.

(j) As a result of the analysis undertaken to date and the further work to be undertaken prior to the start of the works (at detailed design stage), I consider that the completed development is unlikely to be affected by liquefaction and/or lateral spread, i.e. any areas identified as being moderately susceptible to liquefaction under ULS seismic loading will be further investigated and mitigated as part of the subdivision works.

(k) This approach has been agreed by both the geotechnical Peer Reviewer – HD Geotechnical, and Council's technical advisors Tonkin and Taylor Consultants.

Earthworks *(Page 8)*

(l) Site soils are considered to be generally suitable for the proposed cut to fill earthworks, and also for the proposed stormwater soakage system.

Items Raised in Submissions *(Page 8)*

(m) Submission 30 relates to provision for guarding against erosion of the Waikato river riverbank. The earthworks proposed do not encroach into the riverbank area and as such this is not considered to be a geotechnical consideration.

(n) Submission 67 sought clarification on the consideration of natural hazards. Natural hazards such as slope instability, soft and/or expansive ground, liquefaction and lateral spread are addressed in the geotechnical reports submitted. Item 39 of Appendix C within Hamilton City Council's Section 42A report states that these documents provide an adequate assessment of the risks and a proposed treatment of the potential effects of (geotechnical) natural hazards.

Issues Raised in Section 42A Report *(Page 9)*

(o) Mr Brzeski states in his evidence that the work undertaken to date is considered to be sufficient for this stage of the project i.e. resource consent level reporting, but that additional site investigation, assessment and monitoring will be required to support detailed design.

Conclusion *(Page 11)*

(p) The subject site is considered suitable for the proposed residential subdivision provided that the works are undertaken in accordance with the geotechnical recommendations provided, relevant development guidelines, and applicable engineering standards.

INTRODUCTION

2. My name is Paul James Fletcher.

3. I am an Associate Geotechnical Engineer with ENGEO in Auckland. I hold the qualifications of Bachelor of Engineering BE (civil) and Master of Engineering Science MEngSci (geotechnical). I am a chartered professional engineer CPEng and a member of Engineers New Zealand.

4. I have been the geotechnical engineer for numerous residential subdivisions in Auckland, Tauranga and Hamilton during the last 15 years. These projects range in size from two to five hundred residential lots. I have also worked on numerous local and national scale infrastructure projects such as state highway upgrades to SH1, SH16 and SH28, the Auckland Kiwirail Electrification project as well as numerous commercial and industrial developments.

5. I have been retained by Weston Lea Limited to prepare a statement of evidence on its application for land use and subdivision consent from the Hamilton City Council for the Amberfield development.

6. I am familiar with the application site and surrounding environment and have visited the site on a number of occasions during the geotechnical investigations.

7. In preparing this evidence I have reviewed the following documents:

   (a) ENGEO Addendum to Geotechnical Investigation Report. Peacockes Road dated 20 February 2019 reference 14280.000.000_23.

   (b) ENGEO Request for further information letter dated 17 August 2018 (Appendix I to the Request for Information).

   (c) ENGEO Geotechnical Investigation Report. Peacockes Road dated 16 May 2018 reference 14280.000.000_19 (Appendix J to the Assessment of Environmental Effects).

   (d) Hamilton City Council– Section 42A Report dated March 2019.

8. I was responsible for preparing the Geotechnical Investigation Report and Addendum. I also prepared the Geotechnical memorandum that accompanied the section 92 response. My evidence does not repeat all of the detail contained in these reports.

CODE OF CONDUCT

9. I have read the Environment Court Code of Conduct for expert witnesses, and agree to comply with it.

10. I confirm that the topics and opinions addressed in this statement are within my area of expertise except where I state that I have relied on the evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

SLOPE STABILTY

11. ENGEO has undertaken a detailed geotechnical investigation of the subject site involving rotary core boreholes, Cone Penetration Testing (CPT) and Seismic Cone Penetration (sCPT) testing, test pits and hand auger boreholes.

12. I was involved with determining the scope of the geotechnical investigation and groundwater monitoring regime for this site. This information has been used to evaluate the stability of the existing and proposed landforms.

13. Current landforms onsite encompass a number of broad river terraces with steep transition slopes between terraces and large, steep, free face slopes bordering the Waikato River. There is also a large gully cutting through the centre of the site.

14. Earthworks proposed as part of this development will decrease the inclination of these stepped contours to create a single broad, gentle slope extending down from Peacockes Road in the West to the eastern edge of the proposed earthworks which typically terminate immediately west of the steeper riparian slopes contained within the Waikato Riverbank and Gully Hazard area.

15. The area of the site requiring the most detailed geotechnical stability assessment is the steep slopes leading down to the Waikato River. These portions of the site have been designated a Specific Design Zone by ENGEO. The Specific Design Zones encompass the Waikato Riverbank and Gully Hazard Area. All development within the Specific Design Zones will be subject to further geotechnical investigation, and assessment and will include engineering measures required to achieve acceptable factors of safety against slope instability. The extent of these areas has been determined based on slope stability and liquefaction analyses.

16. The north eastern portion of the site has also undergone a re-design to accommodate further areas of buffering/mitigation for ecological reasons. This re-design incorporates a wider buffer zone around the eastern edge of the proposed development and leads to less fill being placed adjacent to the steep banks of the Waikato River. This work will improve the stability of this portion of the site above that which would have been achieved for the original development proposal.

17. The Waikato Riverbank and Gully Hazard Area lies within the designated Specific Design Zones and as such development proposed within this area such as walkways and cycle paths will be subject to specific investigation and design at detailed design stage.

18. On the basis of the investigations undertaken, I consider that the proposed development will generally increase the stability of the site by decreasing the inclination of the existing stepped contours and maintaining adequate separation from the steeper portions of site – predominantly adjacent to the Waikato River. The residential lots proposed as part of this development will be adequately protected against potential slope instability.

LIQUEFACTION AND LATERAL SPREAD

19. Liquefaction under seismic (earthquake) loading has been extensively investigated, and assessed. Soil liquefaction can manifest as settlement of the ground surface following an earthquake, and as lateral spread.

20. Soil liquefaction has been addressed as follows:

    (a) CPT testing was undertaken as a first screening measure to evaluate liquefaction potential.

    (b) Seismic CPT testing was then undertaken in areas exhibiting greater likelihood of liquefaction to better define the risk. On the basis of the testing, and analysis undertaken, the risk of soil liquefaction is considered low.

    (c) As lateral spread is a consequence of soil liquefaction, where the risk of liquefaction is deemed to be low, the risk of lateral spread is also low.

    (d) Liquefaction under seismic (earthquake) loading has been investigated and assessed to a level considered suitable for resource consent i.e. assessing the suitability of the site for development. It is acknowledged that additional work will be required as part of the detailed design of this development.

(e) Analysis undertaken as part of the Geotechnical Investigation of this site indicates that the risk of liquefaction induced hazard is low to moderate.

(f) As a result of the analysis undertaken to date and the further work to be undertaken prior to the start of the works (at detailed design stage), I consider that the completed development is unlikely to be unduly affected by liquefaction and/or lateral spread. i.e. any areas identified as being moderately susceptible to liquefaction under ultimate limit state (ULS) seismic loading will be further investigated and mitigated as part of the subdivision works.

(g) This approach has been agreed by both the geotechnical Peer Reviewer – HD Geotechnical as part of submitting the resource consent application, and Council's geotechnical advisors, Tonkin and Taylor Consultants in the Section 42A report.

EARTHWORKS

21. Site soils are considered to be generally suitable for the proposed cut to fill earthworks, and also for the proposed stormwater soakage system. Site soils are alluvial in origin, and are thus interlayered and spatially discontinuous. These soils comprise mixtures of predominantly granular soils with some fine grained (clay and silt) soil layers.

ISSUES RAISED IN SUBMISSIONS

22. Submission 30 relates to provision for guarding against erosion of the Waikato river riverbank. The earthworks proposed do not encroach into the riverbank area and as such this is not considered to be a geotechnical consideration.

23. Submission 67 sought clarification on the consideration of natural hazards. Natural hazards such as slope instability, soft and/or expansive ground, liquefaction and lateral spread are addressed in the geotechnical reports previously submitted. Item 39 of Appendix C within Hamilton City Council's Section 42A report states that these documents provide an adequate assessment of the risks and a proposed treatment of the potential effects of (geotechnical) natural hazards.

ISSUES RAISED IN SECTION 42A REPORT

24. Appendix C of the Council's Section 42A report deals with geotechnical issues relating to this development. This statement of evidence was prepared by Mr John Brzeski of Tonkin and Taylor Consultants acting as the geotechnical consultants for Hamilton City Council. The pertinent findings of Mr Brzeski's evidence and my response (where a response is needed) to these findings are as follows:

Site Investigation

(a) Mr Brzeski concludes that the level of site investigation undertaken is considered to be sufficient for this stage of the project. Subsequent assessment of the site investigation data includes an assessment of the geohazards affecting the site and this assessment has been undertaken to a satisfactory standard. I agree with Mr Brzeski's conclusion.

Ground Model

(b) The ground model is considered sufficient for this stage of the project but will need to be refined following the collection of more data to support detailed design. Geological sections prepared for the site will need to be reviewed and updated with additional information at detailed design stages. Information presented on the geological sections will require additional detail for detailed design purposes. I agree, as set out above additional investigation and analysis will be undertaken for specific portions of the development at detailed design stage.

(c) Water level monitoring should continue onsite to collect a full 12 months of groundwater data. I agree and confirm that this monitoring is underway.

Seismic Hazard Assessment

(d) Liquefaction and lateral spread analysis has been peer reviewed by HD Geotechnical and they have stated that overall they agree with

ENGEO that the liquefaction hazard at the site is low to moderate and that in this regard the site is typical for Hamilton.

(e) HD Geotechnical have recommended further definition of liquefaction risk in some parts of the site be undertaken as part of detailed design and that there is likely to be some mitigation required relating to slopes and foundations. I note that Mr Brzeski has agreed with these findings. Further groundwater monitoring, investigation and design will be undertaken as part of specific design for portions of this development. However, work undertaken to date is considered sufficient for the resource consent stage.

Slope Stability Assessment

(f) Slope stability models prepared to date are considered to be sufficient for the resource consent stage but will require comprehensive review at Building Consent stage to ensure they accurately depict ground conditions encountered in site investigations. I agree with this.

(g) Slope stability analyses undertaken to date should be revised at detailed design stage to include the findings of the additional groundwater monitoring recommended by Mr Brzeski and also to incorporate the liquefied case into the slope analyses undertaken for detailed design. I agree with this recommendation.

(h) Review of the revised drawings for the north eastern portion of the site which underwent re-design to accommodate additional bat habitat requirements, show that the effect of this re-design on slope stability is positive.

(i) Mr Brzeski has found that ENGEO have adequately considered slope stability for the proposed development and considers that further investigation, review of the geological model and slope stability analyses will be required for potential mitigation measures as part of detailed design. This is especially pertinent to any areas where changes are made to the current development proposal. I concur with this assessment.

Conclusions and Recommended Conditions of Consent

(j) I agree with the conclusions of Mr Brzeski's evidence and the recommended conditions of consent.

CONCLUSION

25. In summary, I conclude that geotechnical constraints to development have been adequately considered as part of the investigations, analysis and reporting undertaken to date for this project and that provided the recommendations of the geotechnical investigation report for this site, the proposed conditions of consent and the relevant development guidelines and applicable engineering standards are followed, this site is considered suitable for the proposed development.

Dated this 12th day of April 2019

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Paul James Fletcher