

IN THE MATTER	OF APPLICATIONS PURSUANT TO THE RESOURCE MANAGEMENT ACT 1991 AMBERFIELD APPLICATION FOR SUBDIVISION AND LAND USE CONSENTS FOR DEVELOPMENT
---------------	--

APPLICANT	WESTON LEA LIMITED
-----------	--------------------

APPLICATION NUMBER	010.2018.00009853.001 011.2018.00006695.001
-----------------------	--

STATEMENT OF EVIDENCE OF JOHN BRZESKI
GEOTECHNICAL
TONKIN & TAYLOR LTD
29 March 2019

INTRODUCTION

QUALIFICATIONS AND EXPERIENCE

- 1 My full name is John Joseph Brzeski. I hold the qualifications of Bachelor of Science with Honours in Applied Geology from Kingston University, London and Masters of Science in Geohazard Assessment from the University of Portsmouth, both in the United Kingdom.
- 2 I have held the position of Engineering Geologist with Tonkin & Taylor for twenty months and have fifteen years of experience in Engineering Geology and Geotechnical Engineering in New Zealand, and the United Kingdom.
- 3 I have been involved in the review of in excess of one hundred land use and subdivision consent applications for Hamilton City Council (HCC) over the last year including four within the Peacocke development area. In my work as a geotechnical consultant in Hamilton I have also undertaken numerous geotechnical investigations within the City and as a result I am familiar with the geotechnical issues commonly encountered in the geological setting of the subject site. Some example projects are given below to illustrate these expertise:
 - a Hamilton City Council liquefaction risk assessment: Geological, geomorphological and quantitative liquefaction assessment for Hamilton City
 - b Hamilton City Planning Guidance unit geotechnical reviews
 - c Hamilton City Building Development unit geotechnical reviews
 - d Peacocke strategic transport package tender team
 - e Pre-purchase geotechnical assessment for site at 410 Peacockes Road
 - f Hamilton Expressway, Huntly Section – Principal's advisor role

INVOLVEMENT IN THE PROJECT

- 4 I have been retained by HCC to provide Geotechnical advice relating to the consent applications by Weston Lea Limited (the applicant).
- 5 As part of my engagement by HCC in the review of the Amberfield development I have undertaken two separate site walkovers on the 5 June and 17 September 2018 and, in preparing this evidence, I have reviewed the following:
 - a Assessment of Environmental Effects prepared by Merestone Ltd dated 17 May 2018;

- b Amberfield Subdivision Geotechnical Investigation Report V2.1 prepared by Engeo Ltd dated 16 May 2018;
- c Amberfield – Peacocke District Plan Overlay prepared by Harrison Grierson dated 18 May 2018 (Appendix U to the AEE).
- d Preliminary Engineering Drawings prepared by Harrison Grierson dated 18 May 2018 (Appendix W to the AEE).
- e s92 response received 17 August 2018;
- f Amberfield liquefaction peer review prepared by HD Geo Ltd dated 5 September 2018
- g Plan of liquefaction potential by EnGeo Ltd dated 4 September 2018
- h Adare H2 Geotechnical Investigation Report Addendum Received 26-02-2019
- i Adare H9 Earthworks Cut-Fill Plans Addendum Received 26-02-2019
- j Adare I1 Finished Contour Plans Addendum Received 26-02-2019

CODE OF CONDUCT

- 6 I confirm that I have read the Code of Conduct for expert witnesses contained in the 2011 Environment Court Practice Note and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions I express. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

SCOPE OF EVIDENCE

- 7 The purpose of this statement of evidence is to address matters raised in the applications relating to geotechnical risks and geohazards and consideration of submissions in this regard.
- 8 My evidence covers:
 - a Review and assessment of applicant's geotechnical assessment against the relevant statutory provisions (e.g. RMA, Regional Policy Statement, District Plan)
 - b Response to submissions
 - c Recommended conditions
 - d Conclusion

THE PROPOSAL

- 9 The applicant is seeking consent to develop a subdivision at the Amberfield site which is located within the Peacocke structure plan area. The proposal is for some

800 residential lots with a range of lot sizes from 400m² to over 700m². From my site walkovers I have observed that the current land use is predominately agricultural. The Amberfield site is located along the terraces above the Waikato River.

- 10 The preliminary engineering drawings and geotechnical report show that extensive earthworks and ground improvements are required as part of the subdivision to provide building platforms for individual lots, stormwater management devices and roads.

BACKGROUND

- 11 This review covers Hamilton City Operative District Plan (ODP) considerations with respect to the actual and potential effects of the proposal on geohazards and the actual and potential effects of geohazards on the proposal. This review has been guided by the following provisions of the ODP as well as section 106 of the Resource Management Act with regards to the management of Natural Hazards, and section 3.24 of the Waikato Regional Policy Statement.
- 12 In this review I have been assisted by Mike Jacka and James Russell (T+T) regarding liquefaction and Tim Coote (T+T) has provided further geotechnical oversight.

TECHNICAL REPORT DISCUSSION

Site Investigation

- 13 Site investigation works have been undertaken by EnGeo Ltd on behalf of the applicant (refer Appendix J of the application documents). Investigation locations appear to have been chosen to target specific geomorphological and design features whilst also maintaining a good general spread across the site. EnGeo Ltd employed a number of techniques to investigate the surface soils and deeper soils across the site and also undertook geotechnical laboratory testing. Aerial photography was also consulted as part of the investigation. In my opinion the level of site investigation undertaken is sufficient for this stage of the project.
- 14 The subsequent assessment of the site investigation data includes an assessment of the geohazards affecting the site and in my opinion has been undertaken to a satisfactory level for a resource consent application.

Ground Model

- 15 EnGeo Ltd developed a basic ground model based on the lithology of the materials encountered. They split the site into three basic soil units of Sand, Silt & Clay and Very Dense Soils that are interbedded with one another. They discuss the spatial distribution of these soils with sandy material being more prominent in the east and cohesive soils in the west. In my opinion, this basic ground model is sufficient for this stage of the project but it will need to be refined following the collection of more data to support detailed design.
- 16 Geological sections have been provided in the EnGeo Ltd report and subsequent further information responses. The investigations used to determine the ground conditions are indicated on some geological sections but not all. This is an important detail as it allows design assumptions to be checked at detailed design stage.
- 17 I retain some concerns that the presented geological cross sections do not accurately reflect what was encountered in the site investigations. While the level of detail presented at resource consent is probably sufficient, a thorough review should be undertaken when additional information is added at detailed design stage. Subsequent assessments that make use of this ground model will also need to be reviewed at this stage.
- 18 Water levels monitored have been monitored at time of investigations and in some locations with remote level loggers to provide long term groundwater levels. The data presented to date shows some fluctuation but the winter high level has not yet been determined. The water levels used in the geotechnical assessments provide conservatism to account for fluctuations in the water table, however, in my opinion monitoring should continue in order to provide a full 12 months of data.

Seismic Hazard Assessment

- 19 The applicant has undertaken an appropriate assessment of the potential liquefaction hazard for the site. Upon request by HCC and in line with MBIE/MfE/EQC (2017) guidelines, an independent peer review of the assessment was provided by HD Geo Ltd.
- 20 The liquefaction hazard was assessed for 3 return periods, 1 in 25 year, 1 in 150 year and 1 in 500 year. These return periods represent the Service, Intermediate

and Ultimate Limit States. The return periods assessed are in line with the requirements of the Bridge Manual and MBIE/MfE/EQC (2017) guidelines.

- 21 The liquefaction hazard has been assessed as “low to moderate” and is shown on a plan of liquefaction potential. These categories are in line with the MBIE Module 3 guidelines on liquefaction identification, assessment and mitigation.
- 22 The sCPT undertaken as part of the site investigation have not been relied upon in the assessment of the liquefaction hazard. In my opinion, if the applicant wishes to incorporate shear wave velocity methods for estimating liquefaction potential of the site during detailed design, it will be necessary to conduct standard CPT in the same location in order to better correlate the data.
- 23 The recommendations of the peer reviewer are for further investigation and assessment to determine what mitigation is required in the parts of the site that have been assessed as having a “moderate ” risk of liquefaction-induced ground damage occurring in the 1 in 500 year seismic event. Based on the information presented in the application and subsequent s92 responses, this is a valid recommendation in my opinion, and can be undertaken at the detailed design stage.

Slope Stability Assessment

- 24 The slope stability assessments appear to use the soil models given in the geological sections developed for the site. As mentioned in paragraph 16, the sections need to be updated with more information at Building Consent stage and at Building Consent stage should be comprehensively reviewed to ensure they accurately depict the conditions encountered in the investigations.
- 25 EnGeo Ltd have modelled three slope stability scenarios (static, elevated groundwater and seismic). The groundwater levels used in these assessments is based on the levels recorded during and two weeks after the investigation. The levels used appear to provide a conservative approach but in my opinion the assessment needs to be reviewed once the groundwater model has been refined as part of detailed design.
- 26 No Liquefied case was considered in the original slope stability assessment. The S92 response on this matter considers a liquefied case at one geological section only, and states that the slope setbacks calculated for the post-earthquake liquefied case is no greater than the current setback illustrated by the specific

engineer design zone on the Geotechnical Constraints map. In my opinion this is sufficient for this stage of the project but further assessment of other geological sections will need to be provided at detailed design stage.

- 27 EnGeo Ltd have reviewed the amended earthworks plans for the northern part of the site that have been developed to mitigate the effect on the habitat of local bat species in the area. They have concluded that the effect on geotechnical issues is positive as the toe of proposed embankments have been moved further away from the critical parts of the river bank and slopes have not been steepened. My review of the drawings supports EnGeo's assessment.
- 28 In my opinion, EnGeo Ltd have adequately considered slope stability for the proposed development and suggested potential mitigation measures such as reinforced slopes and subsoil drains to achieve acceptable factors of safety, all of which appear appropriate but will need further investigation, analysis and specific engineer design. The analysis should be repeated at detailed design stage once the geological model has been refined and comprehensively reviewed. Slope stability analyses should also be repeated in the event of any changes to the proposed ground levels or batters. This is especially relevant given the changes to the northern parts of the site.

Geotechnical Constraints

- 29 EnGeo Ltd have provided a geotechnical constraints plan (refer Appendix 3 of their report). From my review of the EnGeo Ltd report I conclude that the main constraint is slope stability. Given my previous comments on the slope stability assessments it is my opinion that the applicant has provided sufficient information for resource consent purposes, however, further investigation and analyses are required to confirm and refine the assessment during detailed design. This is especially relevant given the changes to the northern parts of the site.
- 30 A liquefaction potential map was produced by EnGeo Ltd as part of the updated liquefaction assessment undertaken in response to the Peer Review by HD Geo Ltd. It is my understanding that the areas of moderate hazard or high susceptibility (*as described in the liquefaction assessment Peer Review*) will be further assessed at detailed design stage. In my opinion, the level of investigation and assessment is in line with current guidelines for assessing the risk of liquefaction for resource consent purposes.

- 31 The geotechnical constraints and liquefaction potential map should be re-assessed given the changes to the northern parts of the site and if there are any subsequent changes to the assessed development proposal at detailed design stage.

Gully Hazard Zone

- 32 Current development plans show that no building is proposed in the gully hazard zone, any changes that result in an encroachment in to the Gully Hazard Zone will require re-assessment in line with the Operative District Plan. EnGeo propose that the Gully Hazard Area that encompasses Lot 299 in the first application has been incorrectly zoned on the hazard map [Section 14.4]. Based on my observations during two site visits this appears to be the case. Council may wish to consider updating the gully hazard overlay.

Foundations

- 33 Geotechnical ultimate bearing capacity (GUBC) is discussed in section 14.6 of the EnGeo Ltd report. A GUBC of 300kPa ("Good Ground" pursuant to NZS304:2001) is generally expected to be available across the site albeit with some localized variations which can be treated during the earthworks or with modifications to the design of foundations. In my opinion this is a reasonable claim.
- 34 As required by NZS4431 (Code of Practice for Earth Fill for Residential Development), a Geotechnical Completion Report (GCR) shall be prepared following subdivision works. The GCR will need to address foundation types, bearing capacity, settlement (both static and liquefaction-induced) and any other geotechnical criteria for each lot.

Stormwater and wastewater management

- 35 The interaction between the subsoil drainage (including counterfort drains) and the stormwater/wastewater management systems was unclear in the application. The geotechnical subsoil drainage should be protected from all other water management infrastructure to ensure that the adequate factors of safety are maintained. Further information responses on the matter have provided a modified design proposal and confirmed that the underfill and counterfort drains will be designed and constructed to be protected from the stormwater and wastewater systems. In my opinion, Amberfield have provided sufficient

information on this matter at this stage but further details should be provided during detailed design.

Earthworks

- 36 In my opinion, reasonable recommendations for earthworks have been provided in the EnGeo Ltd report (Section 14.9 to 14.12). A full earthworks specification with associated standard detail drawings should be developed at detailed design stage that covers topics including, but not limited to gully filling, material suitability, pumiceous silts, benching of slopes, cut and fill batters, unsuitables and surface and subsoil drainage. Site-won fill materials may not be suitable for re-use.

Bridge and culvert crossings

- 37 EnGeo Ltd made no specific reference to the bridge and culvert that cross the gully to the Island in their geotechnical report. The subsequent s92 response confirmed that the ground was suitable for these structures subject to further investigation and specific design. In my opinion, given this statement and the presence of specific investigations in these locations, this is sufficient for this stage of the project.

SUBMISSIONS

- 38 Submission Number 30 sought better provision for guarding against erosion of the riverbank in the distant future. The earthworks plan does not encroach into the riverbank area so earthworks for the development does not exacerbate the current risk of erosion to the riverbank. Stormwater outfalls constructed within the riverbanks will be designed and constructed with erosion protection, however, this detail will be covered in evidence to be prepared by others.
- 39 Submission Number 67 sought clarification on the consideration of natural hazards. From a geotechnical perspective, the applicant has assessed the wide range of geohazards that could affect the site and has provided a "Geotechnical Constraints Map" and "Map of Liquefaction Potential". These documents, when read in conjunction with the geotechnical report, provide an adequate assessment of the risks and a proposed treatment of the potential effects of (geotechnical) Natural Hazards. My evidence in this regard covers geo-hazards only, specifically seismic hazards, soft-ground, slope instability and expansive

soils. Natural hazards relating to flood potential is covered in the review assessment by Mr Caleb Clarke of Morphum Ltd.

CONCLUSION

- 40 In summary, it is my opinion that geotechnical constraints for the subdivision have been adequately considered through intrusive investigations, monitoring, assessment and analysis. More information is required at detailed design stage to confirm the recommendations made at Resource Consent stage. It is my opinion that, subject to compliance with the recommended conditions as set out below, the Amberfield subdivision works can be undertaken without an adverse effect on Natural Hazards.
- 41 It is my opinion that, subject to compliance with the recommended conditions as set out below, the Amberfield subdivision works will result in suitable building platforms for residential development with respect to risk from geohazards. Noting that some areas will require specific engineer design to mitigate the effect of geohazards.
- 42 In my opinion, the geotechnical report satisfies the requirements of s106 of the RMA in terms of the identification of (geotechnical) natural hazards and the assessment of their effects on the site and the surrounding area.

RECOMMENED CONDITIONS

- 43 The following recommendations should addressed by conditions of consent. I have reviewed the recommended conditions appended to the Section 42a report and I am satisfied that these recommendations are adequately covered in these conditions.
- a) The investigation, design and specification of subdivision earthworks should be carried out or reviewed by a Chartered Professional Engineer practicing in geotechnical engineering or an experienced Engineering Geologist.
 - b) Subdivision earthworks design should include consideration of ground stabilisation earthworks and subsoil drainage.
 - c) Existing uncontrolled fill on the site should be removed or replaced with engineered fill to form building platforms and subgrade for roads and services.
 - d) The design of earthworks and slope re profiling to provide the subdivision layout should be reviewed by a Chartered Professional Engineer practicing in geotechnical engineering or an experienced Engineering Geologist, and

earthworks construction should be monitored by a Geotechnical Engineer or Engineering Geologist.

- e) On satisfactory completion of earthworks the Geotechnical Engineer or Engineering Geologist should submit a geotechnical completion report and Statement of Professional Opinion as to suitability of the land for Building Construction, and include any recommendations for the building development on the lots.
- f) All earthworks should be carried out in accordance with NZS4431:1989.
- g) The investigation and design of excavations in excess of 1.0 m deep should be carried out or reviewed by a Chartered Professional Engineer practicing in geotechnical engineering or an experienced Engineering Geologist. The effect of excavation on global stability should be assessed.
- h) The investigation and design of fills in excess of 1.0 m high or any fill on ground sloping at more than 3H: 1V should be carried out or reviewed by a Chartered Professional Engineer practicing in geotechnical engineering or an experienced Engineering Geologist. The effect of filling on global stability should be assessed.
- i) All fill foundations should be stripped, benched and drained. All fill placed on ground sloping at greater than 1V:3H and all fill to support structures shall be placed in accordance with NZS 4431:1989.
- j) The investigation and design of retaining walls should be carried out or reviewed by a Chartered Professional Engineer practicing in geotechnical engineering. All walls shall be adequately drained.
- k) An erosion and sediment control plan must be prepared prior to the commencement of earthworks and should specify measures to avoid adverse offsite effects arising from the subdivision construction works.
- l) Specific Engineer Design of MSE walls, ground improvements, bridges and other significant structures should be peer reviewed.
- m) Earthworks specification and associated standard detail drawings to be provided as part of detailed design.
- n) The "Specific Design Zone" shall be reviewed and revised at detailed design stage.

- o) Any building within the “Specific Design Zone” shall address the Key Geotechnical Constraints as detailed in section 14.2 of the Subdivision Geotechnical Report.
- p) The ownership and maintenance of subsoil drains should be taken into account where ground improvement and long term slope stability is reliant on subsoil drainage to control groundwater levels.
- q) Further groundwater monitoring to be undertaken to support detailed design
- r) Lot-specific conditions for development of the lots to be recommended as part of the site suitability process.

Signature:

A handwritten signature in black ink, appearing to read 'B. J. Smith', is written over a light gray grid background.

Date: 29th March 2019

\\hamdc\corporate\hamilton\projects\1007095\workingmaterial\geotech\geotech evidence_jb_29032019 final.docx