

**IN THE MATTER**

of the Resource Management Act 1991  
("RMA" or "the Act")

**AND**

**IN THE MATTER**

of an application to **HAMILTON CITY COUNCIL** for private plan change 7 to the operative Hamilton City District Plan by **GREEN SEED CONSULTANTS LIMITED**

**STATEMENT OF EVIDENCE OF ANDREW HOLLAND**

**1. INTRODUCTION**

1.1 My name is Andrew James Holland. I am the Technical Director at HD Geo Limited.

**Qualifications and experience**

1.2 I am a Chartered Professional Engineer (CPEng) and have a Bachelor's degree in Engineering (BE (Hons)) from the University of Auckland (2002).

1.3 I have been in my role at HD Geo Limited for 7 years, and I have 20 years' experience working as a geotechnical engineer. I have worked in geotechnical engineering in New Zealand and in England. I am a chartered member of Engineering New Zealand and a member of the New Zealand Geotechnical Society.

1.4 I have worked in Waikato since 2009, performing geotechnical investigations, assessments and designs on numerous land development, building and infrastructure projects. Land development projects I have been involved in recently include Rotokauri Rise, Aurora (Peacockes), Rangitahi (Raglan), Te Rapa Gateway, North Point Estate and Brymer Rd.

**Involvement in the Project**

1.5 I was engaged by Green Seed Consultants Limited ("GSCL") to undertake assessments for the Rotokauri North Special Housing Area ("SHA"). The SHA area is the same area that is now sought to be re-zoned by way of Plan Change 7 ("PC7"). Thus, my previous assessments remain valid for (and were used to support) the PC7 request.

1.6 The purpose of my assessments was to assess the geotechnical suitability of the PC7 land for residential development. We (HD Geo Limited) have recently also been engaged to undertake the more detailed investigations, assessments and geotechnical design work for the subdivision of Stage 1 of that land.

- 1.7 My last site visit was early 2020; however, I am familiar with the land having undertaken many site visits to undertake our assessments and reports for PC7.
- 1.8 As part of assessing the geotechnical suitability of the site for residential development, I (or colleagues under my supervision) have prepared the following reports:
- (a) Rotokauri North SHA, Preliminary Geotechnical Report, 27 July 2018. A copy of this report is **attached as Annexure A**, as the results from this form the basis for the Liquefaction Hazard Study referred to in sub-paragraph (d) below.
  - (b) Rotokauri North SHA, Geotechnical Assessment Report, 25 October 2018 ("2018 Report"). This was included as Attachment 7 to PC7.
  - (c) Response to Hamilton City Council ("HCC") Peer Review, 27 February 2019. This was also included as Attachment 7 to PC7.
  - (d) Rotokauri North SHA, Liquefaction Hazard Study ("2019 Study"), 12 June 2019. A copy of this study is **attached as Annexure B**, as it was prepared after PC7 was lodged and therefore is not included in the application material as notified.

#### **Purpose and scope of evidence**

- 1.9 The purpose of my evidence is to present, at a high level, the findings of the above geotechnical assessments. In that regard, my evidence will address the following matters:
- (a) Summary of PC7 and the PC7 land (Section 3);
  - (b) Methodology for the geotechnical assessment (Section 4);
  - (c) Summary of findings from the geotechnical assessments and perceived geotechnical constraints and hazards (Section 5);
  - (d) Comments on the section 42A report prepared for HCC (Section 6);
  - (e) Comments on the proposed PC7 provisions (Section 7); and
  - (f) Conclusions (Section 8).
- 1.10 A summary of my evidence is set out in Section 2 below.

#### **Expert Witness Code of Conduct**

- 1.11 I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's 2014 Practice Note. 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.

## **2. SUMMARY OF EVIDENCE**

- 2.1 My evidence briefly describes the PC7 land and presents the methodology and findings of the above assessments to determine if that land is suitable for residential development, as proposed by PC7.
- 2.2 To form my opinion about the suitability of the PC7 land for urban development, I undertook a high level review of available information and a preliminary site investigation. This included overseeing in-situ testing which provided ground engineering parameters for assessment. I then used the outcomes from that work to identify potential natural (geotechnical) hazards that could affect (or constrain) development of the site for residential use.
- 2.3 My assessment identified that the PC7 land has the following characteristics:
  - (a) Other than some small areas of hill terrain, the site is generally flat, with no significant slopes or steep gradients.
  - (b) Liquefaction was the main hazard that would affect the development and the appropriate measures to address this are outlined in detail in the 2019 Study.
  - (c) Other, less severe hazards could include soft soils and settlement.
- 2.4 All of the identified hazards are typical of the Hamilton area and are readily mitigated through construction of development structures, or through specification of resilient foundations for new buildings. These matters are required to be addressed during the consent stage, primarily in accordance with relevant provisions of both the Resource Management Act 1991 ("RMA") and the Building Act 2004 ("BA").
- 2.5 On the basis of the assessment I have undertaken, in my opinion:
  - (a) There are no hazards that have been identified that would preclude development of the PC7 land; and
  - (b) Provided that the geotechnical recommendations given within my report and provided in this statement of evidence are followed, and the appropriate engineering measures are implemented at subdivision development stage, the PC7 land is suitable to be re-zoned for residential development, as is proposed.

### **3. SUMMARY OF PC7 AND THE PC7 LAND**

#### **The proposal**

- 3.1 PC7 seeks to rezone approximately 140ha of land from Future Urban zone to Medium Density Residential zone, and Business 6 (Neighbourhood Centre) zone. The site consists of several individual rural and rural lifestyle properties separated by fences and established hedges.
- 3.2 The proposal is intended to facilitate residential development, a neighbourhood centre, and other community facilities including a school, and open green spaces.

#### **The site**

- 3.3 The PC7 land comprises approximately 140 hectares in Rotokauri North, bounded by Te Kowhai Road (SH39) to the north, greenfields land to the east and south, and Exelby Road to the west and south. Burbush Road runs north to south through the east of the site.
- 3.4 The site is largely undeveloped and is predominantly used for agriculture with grazed pasture, and some rural-residential lifestyle dwellings.
- 3.5 I address other relevant characteristics of the PC7 land (including topography and its underlying geology) in Section 5 below.

### **4. GEOTECHNICAL ASSESSMENT METHODOLOGY**

- 4.1 The geotechnical/site suitability assessment undertaken by HD Geo Limited involved a site wide investigation, at a high level, to identify natural geotechnical hazards that could affect the suitability of the site for residential development.
- 4.2 The assessment included:
- (a) A desktop study of available information;
  - (b) A detailed site walkover; and
  - (c) Scattered intrusive testing to broadly characterise the ground conditions within the PC7 land. This testing consisted of:
    - (i) 13 hand augers up to 3 m depth;
    - (ii) 8 cone penetrometer tests ("CPTs") up to 20 m depth;
    - (iii) 3 dissipation tests; and

(iv) 5 temporary standpipe piezometers.

4.3 In order to understand the potential liquefaction hazard in more detail, the following testing has been undertaken:

- (a) Installation of 5 permanent piezometers (August 2018); and
- (b) 6 shear wave velocity tests by seismic cone CPTs up to 20 m depth (October 2018).
- (c) 6 investigation trenches, 1m deep and up to 10m long to look for soil features indicative of paleoliquefaction

4.4 The data gathered in the investigation was then analysed to understand the hazards. Having identified likely hazards, I then assessed the suitability of the site for the proposed residential development.

## 5. **ASSESSMENT FINDINGS**

### **Geology and geomorphology**

5.1 My investigation found that the site is primarily on the Hinuera Plains, a broad, low angle alluvial fan in the Hamilton Basin. The Hinuera Plains are made up of alluvial silt, sand and gravel with some peat. The plains are typically flat, with open drains in areas to control surface water. There is an isolated area of Hills Terrain along the western edge of the site (near Exelby Road). The Hills Terrain is gently sloping to rolling and is underlain by the Walton Subgroup. The Walton Subgroup is alluvium dominated by primary and reworked, non-welded ignimbrite. The Walton Subgroup is generally mantled with a layer of weathered ash, which can be several meters thick. These conditions are typical of Hamilton/central Waikato sites.

### **Geotechnical hazards**

5.2 In summary, the potential geotechnical hazards identified on the site are as follows.

#### *Liquefaction*

5.3 My assessment of the site showed that the site has a high liquefaction hazard (particularly across the plains areas) and a possibility of soft soils in places.

5.4 Liquefaction is a common hazard in the Hamilton Basin. The risks associated with liquefaction can be mitigated in part through appropriate subdivision design, but will primarily be addressed through a combination of the following:

- (a) Shallow ground improvement (to separate structures from liquefiable layers);

- (b) Reinforced raft foundations (varying from simple ribraft to reinforced, resilient raft foundations;
- (c) Piles to non-liquefying layers;
- (d) De-watering to reduce the hazard (usually locally to a lateral spreading hazard); and
- (e) Setbacks or barrier piles in some locations where lateral spreading was considered to be a risk.

#### *Lateral spreading*

- 5.5 Lateral spreading is a phenomenon where liquefied material allows the soil above to move laterally towards a free face, such as a stream bank. The site currently has an isolated lateral spreading risk adjacent to the Te Kowhai Channel in the north-eastern corner of site and adjacent to proposed stormwater channels and ponds.
- 5.6 Specific assessment of the lateral spreading hazard will therefore be required at resource consent stage. Potential mitigation options of lateral spreading risks may include:
- (a) De-watering of adjacent ground so liquefaction is unable to occur;
  - (b) Using a buttress of ground improvement along swale edges;
  - (c) Slope stabilisation methods; and
  - (d) Specifying foundation types tolerant to lateral spreading in high risk areas.

#### *Soft soils and settlement*

- 5.7 Isolated soft soils were encountered at the site. These were typically shallow and will be mitigated during construction, typically by undercutting.

### **Recommendations and further work**

- 5.8 The recommendations from the 2018 Report were that:
- (a) The liquefaction hazard at the site should be refined through further investigation and assessment, to identify required mitigation measures where necessary;
  - (b) Assessment of the liquefaction induced lateral spreading risk adjacent to proposed stormwater swales should be completed; and

- (c) In terms of future work at the resource consent stage:
  - (i) As the risk of consolidation settlements are often greatest in paleochannels and hilly embayments, these areas should be targeted by future investigations; and
  - (ii) Further investigation of the potential cut areas of site should be completed to define the materials to be used or exposed in earthworks.
- (d) The matters from subparagraphs (a) and (b) are addressed in the 2019 Study, while those from subparagraph (c) are to be addressed at the resource consent stage.

### **Suitability of site for development**

- 5.9 While the site is subject to some natural (geotechnical) hazards, these are not so severe as to preclude urban development. By properly assessing and designing mitigation for hazards identified on site, severe hazards can be avoided. Mitigation is routine in this region, such as resilient foundations for future buildings, and is reasonable. In my opinion (and subject to adoption of the recommendations from my reports), the site is suitable for urban development as proposed.
- 5.10 Although my analysis has been prepared to inform a plan change, I have also considered whether the site will be able to comply with the provisions of section 106(1)(a) of the RMA, something which is usually done at the resource consent stage. This provision states that a consent authority may refuse to grant a subdivision consent if there is a significant risk from natural hazards.
- 5.11 I have reviewed the available information on natural and man-made hazards, such as seismicity and active faulting, soil liquefaction and slope instability. Having regard to the various assessments I have undertaken as outlined above (and the outcomes of those assessments), in my view there are no significant risks from natural and man-made (geotechnical) hazards that will prevent the development of the site. This assessment will, however, of course be reviewed and updated at the time of subdivision consent, as required.

### **6. COMMENTS ON MATTERS RAISED IN THE OFFICER'S REPORT**

- 6.1 The section 42A report author agrees that land is generally suitable for urban development, and that geotechnical effects can be satisfactorily managed. I also agree with the author's comment (at paragraph 4.75 of the report) that there are no specific geotechnical issues raised by submitters that need to be addressed.

- 6.2 There are no other geotechnical issues raised in the section 42A report that I need to comment on.

7. **PROPOSED PLAN PROVISIONS**

- 7.1 There are no proposed plan provisions that relate to geotechnical matters, nor in my view are any required. The geotechnical matters I have raised above will be appropriately addressed during the subdivision and building consent phases, as required in accordance with the RMA (in particular, section 106(1)(a)) and relevant provisions of the BA.

8. **CONCLUSION**

- 8.1 Based on the above assessment and analysis, and subject to complying with the recommendations I have made in my reports and in this evidence, in my opinion while there are geotechnical hazards present on the site, these hazards can be appropriately mitigated through design and other standard engineering practices. As such, I consider the PC7 land is geotechnically suitable for the proposed residential development.

**Andrew James Holland**

**24 September 2021**



## **Annexure A**

Rotokauri North SHA, Preliminary Geotechnical Report, 27 July 2018.

## **Annexure B**

Rotokauri North SHA, Liquefaction Hazard Study, 12 June 2019.