Appendix C
Geotechnical Desktop Assessment

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Rebecca Parish
Property Development Manager
Foodstuffs South Island Limited
Via email: Rebecca.Parish@foodstuffs-si.co.nz

Dear Rebecca

Rolleston PAK'n SAVE, 157 Levi Road – Geotechnical Desktop Assessment Letter
Our Ref: 229723

1. Introduction

Foodstuffs South Island (Foodstuffs) are proposing to develop a new PAK'n SAVE Supermarket in Rolleston, Canterbury at their site located at 157 Levi Road on the northeast side of the Levi Road and Lincoln-Rolleston Road intersection. Conceptual drawings of the proposed development, provided by McCoy and Wixon Architects dated 29 October 2021 indicate a supermarket structure of approximately 7,230m^2, a fuel facility, at grade carparking for the supermarket, and stormwater basins on the southwest corner of the site. The development will be undertaken in the northern portion of the site.

Foodstuffs have engaged Aurecon New Zealand Limited (Aurecon) to provide advisory, planning, and geotechnical engineering services for the proposed development. This geotechnical desktop assessment has been prepared to support a resource consent application for land use consent and presents Aurecon's review of readily available geotechnical information implications for the proposed development. Aurecon's explanatory statement is provided in Section 5 of this letter.

2. Site Conditions

2.1. Site Description

The proposed supermarket development site is located at 157 Levi Road, Rolleston at the corner of Levi Road and Lincoln-Rolleston Road. The site features are as follows:

- The site has a legal description of RS7556 and has an approximate area of 7.2Ha.
- The site is bounded by rural property to the east, Levi Road to the north and Lincoln Rolleston Road to the west/south.
- The site is currently occupied by predominantly rural paddocks, with associated vegetation and shelter belts. A residential dwelling and two sheds are in the northern portion of the site.
- The site is relatively flat and level.

2.2. Geological Maps

Based on the regional geology as described by Forsyth, Barrell and Jongens (2008), the site is underlain by *"Grey river alluvium beneath plains or low-level terraces"*.

2.3. Historical Seismic Performance

The site has experienced significant seismic shaking during the Canterbury Earthquake Sequence (CES) from 2010 to 2012. The Rolleston area experienced shaking of approximately 0.34g during the September 2010 Earthquake (Bradley, 2012). The Rolleston area was not mapped for earthquake induced ground damage following the CES, however based on Aurecon's review of the available aerial imagery there is no evidence of liquefaction induced ground damage such as ejecta or sand boils at the site or any of the surrounding area.

2.4. Listed Land Use Register

A review of the Environment Canterbury Listed Land Use Register did not identify any information regarding Hazardous Activities and Industries List at the site.

2.5. Aerial Photography Review

A review of available historical aerial photographs for the site indicates the earliest aerial was flown in 1942. This earliest aerial indicates the site has been used for agricultural purposes since at least 1942 however since the 1980 – 1984 aerial, the site appears to have been dissected into multiple fenced paddocks. By the 1990 – 1994 aerial photograph series, a residential house was constructed in the northern end of the site. Additional structures have been constructed since 2000 including multiple sheds across the north-western corner of the site, and hedge rows and trees have become established.

3. Geotechnical Investigation Review

3.1. Introduction

Aurecon have completed a review of the readily available investigations from the following sources:

- Previous Aurecon projects located in the vicinity of the site.
- New Zealand Geotechnical Database.
- Environment Canterbury GIS Viewer.

3.2. Previous Aurecon Investigations (2016 to 2017)

Aurecon undertook a series of geotechnical investigations to support a subdivision development approximately 500m to 1000m south of the proposed PAK'n SAVE development. The investigations series comprised machine dug test pits and handheld auger boreholes, and indicated the area was typically underlain by surficial topsoil, a silt crust varying in thickness up to approximately 1m followed by dense sandy gravels to depth. Groundwater was not encountered in any of the tests pit excavations in the upper 4m of the soil profile.

3.3. New Zealand Geotechnical Database

A review of the available geotechnical investigations on the New Zealand Geotechnical Database (NZGD) indicated the nearest investigations are 400m northwest of the site and typically comprise shallow handheld testing. Investigations north of the site indicate the thickness of the interbedded silt/sand crust can exceed 2m before encountering gravels.

3.4. Environment Canterbury (ECan) GIS Viewer

A review of the ECan GIS Database shows the site is surrounded by multiple deep wells. Whilst these wells are typically not logged by a Geologist or Geotechnical Engineer, they do provide indicative thicknesses of soil units. A review of the available ECan wells is summarised in Table 1 below.

Table 1 ECan Well Summary

Well ID	Location from Site Boundaries	Depth	Soil Description (depth bgl)	Groundwater Level
M36/4430	50m North East	54m	0m – Earth (Topsoil) 0.3m – Brown Sand 3.5m – Interbedded Sandy Gravel and Sandy Clayey Gravels	17.5m(1)
M36/4743	150m North East	42m	0m – Earth (Topsoil) 0.3m – Brown Clay 1.8m - Interbedded Sandy Gravel and Sandy Clayey Gravels	17.2m(1)
BX23/0827	270m South West	181m	0m – Topsoil 0.3m – Clay 1.5m - Interbedded Sandy Gravel and Sandy Clayey Gravels	13.2m(1)
M36/5292	140m South	52m	0m – Topsoil 0.25m - Interbedded Sandy Gravel and Sandy Clayey Gravels	16.6m(1)

Note:

1) Groundwater readings taken at time of drilling only. No long-term groundwater monitoring has been undertaken.

The ECan GIS viewer groundwater modelling at the site indicates:

- Piezometric contours of the groundwater surface at 30mRL. With ground level at 45mRL this corresponds to a depth of 15mbgl.
- Depth to groundwater contours indicate groundwater depth at 15mbgl.

These depths are approximate only and likely accurate to +/-2m.

3.5. GNS Active Fault Database

A review of the Geological and Nuclear Sciences Active Fault Database (GNS, 2021) indicates two recorded active faults within the vicinity of the site. These faults are summarised in Table 2 below and their locations are shown in Figure 1. From this assessment it can be seen there are known recorded faults within the direct vicinity of the site.

Figure 1 GNS Active Fault Database

Table 2 Active Fault Database Summary

Name	Location from Site	Recurrence Interval	Slip Rate	Single Event Displacement	Comment
Greendale Fault	Eastern trace of fault 3km northwest	10ka to 20ka	Low	Moderate	Movement on this fault that caused the 4 September 2010 Darfield Earthquake
Hororata Fault	Approx. 10km northwest	Unknown	Unknown	Unknown	-

3.6. Site Conceptual Ground Model

Based on Aurecon's review of the available geotechnical investigations, we conclude the ground conditions at the site are likely to comprise surficial topsoil overlying a crust of interbedded silts and sands. These surficial layers are likely to be underlain by gravelly soils to significant depths in the order of hundreds of metres.

Whilst accurate groundwater information is not available, based on Aurecon's understanding of the wider area we consider the depth to groundwater is likely to exceed 10m.

4. Engineering Considerations

4.1. Natural Hazards

Based on Aurecon's review of the available geotechnical investigations, indicating the site is underlain by predominantly dense gravelly soils and a depth to groundwater of at least 10m, Aurecon considers the **risk of seismically induced liquefaction is very low**, in accordance with the definition given in the Ministry of Business, Innovation and Employment's document *Planning and Engineering Guidance for Potentially Liquefaction-Prone Land (2017)*.

No other natural hazards relevant to a geotechnical assessment have been identified at the site due to the underlying ground conditions, distance from known active faulting and flat topographical conditions (i.e. land subsidence, landslide or rock fall hazards) other than ground shaking during a seismic event. This risk, however, is readily addressed by the requirements of the New Zealand Building Code and is not considered further here.

4.2. Foundation Recommendations

Aurecon recommends that the proposed supermarket development is founded on well tied-together shallow concrete foundations. These shallow concrete foundations shall be subject to detailed engineering design by Geotechnical and Structural Engineers at the Building Consent phase of the proposed supermarket development to meet the requirements of the New Zealand Building Code.

4.3. Ongoing Geotechnical Involvement

Aurecon recommend that a suitably qualified Geotechnical Engineer shall be retained to:

- Undertake a detailed site-specific assessment of the sub-surface ground model, especially the thickness of surficial silt deposits across the site, and provide detailed recommendations for foundations and pavements for the development during detailed building design.
- Provide engineering recommendations for the wider development as required.

5. References

Bradley, BA. 2012. *Ground Motions observed in the Darfield and Christchurch earthquakes and the importance of local site response effects.* New Zealand Journal of Geology and Geophysics, Vol 55, No. 3, pages 279-286.

Forsyth, P.J.; Barrell, D.J.A.; Jongens, R, 2008. Geology of the Christchurch Area. Institute of Geological and Nuclear Sciences 1:250 000 Geological Map 16.

GNS, 2021. Active Fault Database. Retrieved 1 November 2021 from http://data.gns.cri.nz/af/.

MfE/MBIE, 2017. *Planning and engineering guidance for potentially liquefaction-prone land*.

New Zealand Geotechnical Database (NZGD), 2021. Retrieved 29 October 2021 from https://www.nzgd.org.nz.

6. Explanatory Statement

We have prepared this letter in accordance with the brief as provided. The contents of the letter are for the sole use of the Client and no responsibility or liability will be accepted to any third party. Data or opinions contained within the letter may not be used in other contexts or for any other purposes without our prior review and agreement.

The recommendations in this letter are based on data collected at specific locations and by using appropriate investigation methods with limited site coverage. Only a finite amount of information has

been collected to meet the specific financial and technical requirements of the Client's brief and this letter does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgment and it must be appreciated that actual conditions could vary from the assumed model.

Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the letter is used after a protracted delay.

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If there are any questions relating to the content of this letter, please let us know.

Written

Kieran Foote

Geotechnical Engineer

Reviewed

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