16 July 2026

Fulton Hogan Land Development Ltd
C/- Town Planning Group
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Re: FHL Parkburn Development – Substantive Application Response to Geotechnical Peer Review

Our Reference: 24019_6

This letter is presented in response to the Geotechnical Peer Review which was completed by WSP New Zealand Ltd (WSP). Their review is presented in a letter dated 24 June 2026, reference number NZL-WSP-6-XH078.00.0215.

This document should be read in conjunction with our prior assessment report entitled *Geotechnical and Earthworks Assessment for Proposed Residential Subdivision at Parkburn Quarry, 922 Luggate-Cromwell Road (SH6), Cromwell*, our reference number 24019_3 V4. It should be considered as an addendum to our prior report.

We note that WSP are in general agreement with the geotechnical findings and conclusions presented in our assessment report, apart from the fact that a National Policy Statement (NPS) Natural Hazard risk assessment was not included. This assessment is therefore presented below, along with some clarifying remarks relating to the design of earthworks.

1 NPS Natural Hazard Risk Assessment

Natural hazards identified by our prior assessment related to seismicity, and alluvial fan and overland flow. As the assessment of the alluvial fan/overland flow flooding potential is outside of the scope of our work, we have excluded this hazard from the assessment.

A copy of the risk matrix from the NPS is presented as Appendix 1 of this letter.

1.1 Seismicity

Seismic effects may be considered as follows:

- Primary effects – ground shaking
- Primary effects – fault rupture
- Secondary effects – liquefaction and lateral spreading

Ground shaking has been excluded from the NPS as ground shaking is already regulated under the Building Act 2004 and the New Zealand Building Code. Therefore, we will consider only active faults/fault rupture, and liquefaction and lateral spreading.

1.1.1 Active Faults/Fault Rupture

The risk of fault rupture (directly affecting built structures or infrastructure) relates to the Pisa Fault Zone being the closest mapped feature to the site. The likelihood level of this event is “very rare” as the current understanding of the Pisa Fault Zone recurrence interval is 22,000 years (>5000 years).

The consequence level at the site is considered to be negligible. This is due to the distance of the site to the current mapped extents of the Pisa Fault Zone (including Fault Awareness Area) ranging between approximately 1.1 and 1.4 km, meaning that the development will not overlap these zones.

Therefore, the assessed matrix risk level for this hazard is *Low*.

1.1.2 Liquefaction

The soil types that are typically susceptible to liquefaction include normally consolidated, relatively young deposits of poorly graded sands, sandy silts, silty sands and fine gravels. Older deposits of well graded, medium dense to dense sands and gravels tend be less susceptible.

Additionally, unsaturated soils above the water table are generally not at risk of liquefaction. Sites with a non-liquefiable crust of at least 3 m deep are generally understood to be less susceptible to liquefaction induced damage at the surface than those with shallower groundwater tables or weak surficial soils.

Taking the above into account, as well as the proposed finished ground surface elevations which will be at least 4 m above the lake level, local geology and future engineered fill to be placed at the site, the overall potential for widespread liquefaction occurring at the site is considered to be low. Localised areas such as the settling ponds, which contain wet and soft deposits, may experience liquefaction if these areas remain unchanged. However, the settling ponds are proposed to be mitigated by earthworks and engineered fill before any dwellings or infrastructure are built over them, therefore removing the potential for liquefaction of these man-made features. Reference should be made to Section 7.1 of our prior report for similar discussion on potential seismic impacts and perceived liquefaction issues.

We have considered the potential and likely consequences for liquefaction at the site resulting from three potential seismic events, taking the above considerations into account:

Alpine Fault Rupture

The annual exceedance probability of the Alpine Fault is taken as between 0.33% and 2.7%. Therefore, this event is taken as being between *Unlikely* and *Likely* on the Likelihood Table.

Shaking intensity at the site is indicated to be MM6 using the Modified Mercalli Intensity scale according to the Otago Regional Council natural hazards portal. This level of ground shaking would be felt by all. Effects of MM6 shaking include difficulty walking steadily, objects falling from shelves, slight damage to some types of buildings, trees and bushes shake and loose material may be dislodged from sloping ground. However, considering the site conditions, widespread liquefaction damage is not expected.

Therefore, the consequence level is considered to be minor. The highest assessed matrix risk level is therefore *Medium*, for unmitigated site conditions.

For mitigated site conditions, including engineered fill to replace the settling pond materials and to increase the ground surface elevation above the lake level, the assessed matrix risk level is *Low*.

Pisa Fault Zone Rupture

As the Pisa Fault Zone has a long recurrence interval (>22,000 years) it is taken as *Very Rare* on the Likelihood Table.

Shaking intensity is not mapped on the ORC natural hazards portal for the Pisa Fault Zone, but MM9 shaking is expected to be exceeded for 1 in 2,500 year events. This level of ground shaking can heavily damage or destroy many buildings, houses not secured to foundations can slide off, ground cracking is conspicuous, and landsliding is possible on steep slopes. However, as the site is generally not susceptible to widespread liquefaction, the consequence level is considered to be minor.

The assessed matrix risk level is therefore *Low*.

Dunstan Fault Rupture

As for the Pisa Fault Zone, the Dunstan Fault Zone has a long recurrence interval of 8,200 years (>5,000 years). Therefore, this event is taken as *Very Rare* on the Likelihood Table.

Shaking intensity is indicated to be MM9. Therefore, anticipated effects are similar to those indicated for the Pisa Fault Zone.

The assessed matrix risk level is therefore *Low*.

1.1.3 Lateral Spreading

Lateral spreading is associated closely with liquefaction, and it is not expected to occur unless soil liquefaction is also occurring. Therefore, we conclude that the assessed risk of lateral spreading may be taken as the same as liquefaction.

For a scenario where an Alpine Fault rupture results in localised soil liquefaction, the assessed risk matrix level is *Medium* for unmitigated conditions. For mitigated site conditions, including engineered earthworks, slope stabilisation, retaining structures and set-back distances (as necessary), the assessed risk level is *Low*.

2 Further Geotechnical Assessment

It is our understanding that detailed geotechnical review, analysis and design of earthworks will be undertaken on a Stage by Stage basis before bulk earthworks commence. This is likely to include the design of benching, excavation and regrading of existing quarry walls, any incorporation of geotechnical reinforcement (e.g. geotextiles), construction methods (subject to fill materials) and planning of settlement monitoring.

It is our further understanding that specific geotechnical investigations will be undertaken to inform the detailed structural design of the Parkburn bridge, as a minimum.

We confirm that settlement monitoring is recommended in our prior report to be undertaken, and the results of the monitoring programme should be used to inform the suitability of filled land for future residential construction, or alternatively, other engineering measures to appropriately mitigate potential settlement impacts on the future development.

3 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Fulton Hogan Land Development Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground and material conditions indicated from published sources, inspections and tests described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site and material characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from the assumed model.

iii. 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.

iv. This Limitation should be read in conjunction with the IPENZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

Report prepared by



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Appendix 1 – Copy of NPS Natural Hazards Risk Matrix

Appendix 1

NPS for Natural Hazards 2025 Risk Matrix

Consequence Level	Likelihood Level						
	Almost Certain	Very Likely	Likely	Possible	Unlikely	Rare	Very Rare
ARI (years)	up to 10	10-20	20-50	50-100	100-500	500-5000	> 5000
AEP	10% or more	10% to 5%	5% to 2%	2% to 1%	1% to 0.2%	0.2% to 0.02%	< 0.02%
Catastrophic	Very High	Very High	Very High	High	Medium	Medium	Medium
Major	Very High	Very High	High	High	Medium	Medium	Medium
Moderate	High	High	High	Medium	Medium	Low	Low
Minor	Medium	Medium	Medium	Medium	Low	Low	Low
Negligible	Low	Low	Low	Low	Low	Low	Low

Note: The top end of the likelihood range includes the top end year, that is: Likely = over 20 years and up to and including 50 years.