

4415  
27 September 2016

Selwyn District Council  
PO Box  
Rolleston

Attention : Catherine Nichol



Dear Ms Nichol,

**RE: Plan Change 49 - Crofts and Williams  
Hauschilds Road, Tai Tapu  
Geotechnical Report Peer Review**

Geotech Consulting has been asked to carry out a peer review on the geotechnical report for the proposed Plan Change to allow future subdivision of 8 ha of land (Lots 1 & 2 DP 436571) adjacent to Hauschilds Road at Tai Tapu. The master plan presented in the report shows a total of 16 proposed lots in the subdivision. The report is titled *Geotechnical Report for Plan Change and Proposed Subdivision* by Davis Ogilvie dated 7 April 2016, for J Williams and Z & S Crofts. In particular the peer review is to ensure compliance with the MBIE guidelines for the geotechnical assessment of subdivisions.

**Outline of report**

The report describes a site investigation of 16 Cone Penetration (CPT) Tests, taken to effective refusal at 13.5m – 15m depth. The soil profile is described as interbedded silt and sand to 4m depth and again at 6.5m – 9m, with interbedded finer clay and silt soils at 4 - 6.5m and 9 – 12.5m. Sand is found below about 12.5m and then dense gravel contacted at between about 12.6m and 14m. The depth to and thickness of these overall strata are variable, as is typical of alluvial soils.

The water table is reported from Ecan well M36/0945, located 100m from the site with readings of 1.1 – 1.3m below ground. We note that this is a 39m deep well into the second gravel aquifer below the site, and the water level may reflect artesian pressures and not the shallow groundwater. A measurement in one CPT hole gave 2.0m depth and interpretation of CPT pore pressure readings indicates 1.9 – 2.6m depth.

Liquefaction assessment includes a review of published information. Maps of liquefaction by GNS on the NZ Geotechnical Database indicate some liquefaction on the land. The Geotech Consulting Study of 2011 showed some liquefaction in the north end of the site in September 2010, and a smaller area in February 2011. It appears that surface expression of liquefaction in the area was relatively minor, even though the report states that the site was well tested to at least SLS levels of shaking in the recent earthquakes. The area has been classified as Foundation Technical Category TC2 by MBIE, but this was based on observed damage and not on ground testing.

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The CPT data has been analysed using the method by Boulanger and Idriss 2014. Estimated settlements are listed in Table 4 of the report, which is assumed to over the upper 10m only. This table gives SLS settlements of 60mm – 120mm and 110mm – 160mm at ULS, which place the site into equivalent TC3 category. Lateral displacements of 75 – 225mm are predicted for the 4 CPTs closest to the river at ULS, but the methodology used to derive these estimates is not known.

The report states that each building site will require ground improvement to reduce the liquefaction to within TC2 limits (or better), plus a fill platform of about 0.4m height to mitigate the flood hazard, and specific engineering of the foundations. Ground improvement methods suggested include a gravel raft, shallow cement stabilized crust, or a crust reinforced with timber pile inclusions. The gravel raft could be suitable for lots 1 – 4 closest to the river with the inclusion of geogrid; the stabilized crust would require specific engineering design to mitigate the lateral spread hazard, but no details are provided, and the timber pile improvement is only suitable for the lots further from the river. TC2 or TC3 foundations could then be used on the improved and raised building platforms.

The report outlines geohazards relevant to RMA section 106 and concludes that flooding and liquefaction are potential hazards, but that these can be mitigated by suitable engineering. The report concludes that the site is suitable for subdivision from a geotechnical perspective, but subject to ground improvement and filling at each building platform, floor levels to provide adequate freeboard to flooding and a site specific geotechnical investigation is carried out at any future building location.

### **Comments**

The site testing provides one deep CPT tests per proposed house site and adequately characterizes the soils to below 15m depth. It complies with the MBIE Guidance for subdivision assessment. The soil profile is relatively uniform under the site which adds to the confidence of the testing.

The central issue geotechnically on the site is the liquefaction hazard. The settlement analysis results are all within the TC3 classification. The report recommendations are that this is addressed by ground improvement. However, the ground improvement options provided are all shallow and do nothing to reduce the liquefaction potential but simply mitigate the effects at each building site.

There is no mention made of infrastructure. The application contains some details of the proposed services to the subdivision. It appears that:

- Stormwater may include two detention ponds and roadside swales, with stormwater management not expected to be vested in the Council (AC 4.30)
- Wastewater is likely to be a low pressure sewer system incorporating an on-site storage tank on each property, with discharge to the Council gravity system in Hauschilds Rd. The tanks and associated pumps would remain in private ownership but the rising main would be vested as a Council asset
- Water supply would be from the existing water main in Hauschilds Rd
- Description of access into each lot has not been located and it is unknown whether the roads off Hauschilds Rd will become Council owned or remain as private ROW.

Information presented on ground shaking does indicate that the site was “well tested” to SLS levels in the September 2010 earthquake. It is clear that some liquefaction did occur in the general area in the earthquake, but not to the extent suggested by the analysis, and the TC2 classification of the built up area of Tai Tapu better reflects the site behavior than the TC3 derived from analysis.

The author personally inspected and reported on a number of properties in Tai Tapu in late 2010, including two almost adjacent to this site, and is aware of the extent of liquefaction and limited ground damage in the earthquakes.

The new subdivision to the south east of the site was approved in 2014. The geotechnical report for that site indicates similar soil conditions as for this one, with similar liquefaction settlements predicted. The report presented arguments that TC2 classification was more appropriate, given the disparity between the observed and predicted ground performance. TC2 foundations have been accepted on that subdivision.

On balance, it is our conclusion that the liquefaction analysis is likely to be over-predicting the liquefaction potential at the site and that behavior is more likely to be TC2 rather than TC3. On this basis we confirm that there is no geotechnical issue preventing re-zoning and subdivision of the land, provided appropriate mitigation measures and foundation designs are used.

Specific comments which will need to be properly addressed at subdivision stage are:

- The need to fill the house sites to mitigate flooding creates topographic gradients on the site, which in turn increases possible lateral spread issues within the site area remote from the river. This aspect may further limit appropriate options to form the building platforms. Incorporation of geogrids into the fill may be necessary.
- The stormwater detention basins also create topographic variations which could induce lateral spread issues. Analysis will be needed to properly identify the risk and assess mitigation measures if needed.
- The four building platforms closest to the Halswell river are potentially susceptible to lateral spread and need to be designed and detailed with this in mind, or sufficient analysis provided to justify no action being needed.
- The DO report recommends that the ground improvement is undertaken at subdivision stage. We concur with this; the building platforms should be complete.
- The DO report states that specific geotechnical testing is needed at each building site at building consent. We consider that this is probably better done at subdivision approval stage to provide additional input into the design of whatever ground improvement and building platform filling is needed. This work if completed at subdivision should remove any need for further testing at building consent stage.
- The wastewater system proposed is a good solution of potentially liquefiable ground, but this should be detailed with possible ground deformation in mind, as should the water supply.
- Access construction details should adequately deal with liquefaction hazard, particularly if the access is to be vested in Council.

**Conclusion**

We accept that the information reported is sufficient to meet the intention of the MBIE Guidance for this plan change and subdivision and that the liquefaction hazard is unlikely to preclude building development. The relatively minor liquefaction damage in the recent earthquakes suggests that the liquefaction analysis over-predicts the liquefaction hazard and that the site is likely to be closer to equivalent to Foundation Technical Category TC2 rather than TC3 as indicated by the analysis. There are a number of aspects that will need to be addressed at subdivision consent stage, as outlined above.

Yours faithfully

**Geotech Consulting Limited**



Ian McCahon