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Job Number: 43285  
MJDS  
2<sup>nd</sup> October 2007

Attention: Peter Williams

Dear Sir

## Kohimarama Retirement Village

### RE: Proposed Concept Plan for Lot 1 DP 332284

Further to our discussions with Messrs Tik and Mackie from Harrison & Grierson and Chow Hill (14/03/07) respectively we confirm receipt of the landscape concept plan prepared by LA4 and a perspective drawing prepared by Zhong. (See copies attached). The development appears to be generally in line with the discussions regarding the construction of multi-storey residential/apartment style accommodation.

Previously we concluded with regard to the stability of the site and its suitability for development and reported:

- “6.2 We have reviewed the results of the detailed stability analyses carried out by FTP and HG in their earlier reports accepted by the ACC for the adjacent property as well as the conclusions of those reports. In our opinion, further detailed stability analyses are not required at this stage as the stability analyses undertaken by FTP and HG indicate that the slopes in Lot 1 outside the existing house and garage platform, are unlikely to be subject to instability. In our opinion, this part of Lot 1 is suitable for recreational use in its current state without additional investigations or analyses.
- 6.3 Instability is known to have affected the area of Lot 1 outside the existing house and garage platform. We therefore recommend that any future development in the remaining area of Lot 1 involving earthworks and/or structures intended for human use or occupation (rather than implement sheds) be subject to specific investigation and design by a suitably qualified geotechnical engineer. We note that future development may require relatively detailed investigation to confirm the long-term stability of the slopes. In addition, it should be noted that the previous stabilisation works that have been carried out on the site and the neighbouring subdivisions indicate that extensive drainage or other stabilisation works may be required to mitigate the effects of any future development”

(Extract from our geotechnical report prepared and submitted to Knight Frank in support of an application made to ACC for subdivision of the land under consideration)

Earlier in that document we also advised that:

*"We have not carried out a detailed check of the stability analyses carried out by HG, however, we consider that the stability analyses indicate that the slopes within the remaining area of Lot 1, i.e. outside the area of the existing house, are also likely to be stable. However, due to the past instability on the site, we consider that any future development on Lot 1, outside the area of the existing house, should be subject to specific investigation and design by a suitably qualified geotechnical engineer. We note that relatively detailed investigation is likely to be required to confirm the long term stability of these slopes and any cut batter is sufficient for residential development without further drainage and/or earthworks. The previous stabilisation works that have been carried out on the site and the neighbouring subdivisions indicate that extensive drainage or other stabilisation works may be required to allow development."*

The proposed scale and style of development will in our opinion require foundations that are specifically designed for the works. These may or may not include a combination of piles and or basements rafts. The design of buildings of the size indicated (up to 5 storeys plus basement), even on a flat site, would typically be supported by several machine boreholes. The need to assess and potentially design stabilisation measures to ensure both long and short term stability will in our opinion necessitate a level of detail and expenditure on geotechnical investigations and design input at a level significantly above that of a conventional site development. We would expect however that an intensive development should be more capable of supporting adequate investigations and stabilisation measures than a low rise development.

The underlying materials at depth beneath the site are expected to be Waitemata Group materials. Typically these weak sedimentary rocks are considered to be capable of carrying foundation loads from multi-storey structures such as the proposed structures which we understand are likely to extend up to 15m (approx 5 stories) above ground level. A history of slope movement is however known to have affected at least the southern part of the site and to have extended across the boundary onto the adjoining school site. Movement on a similar scale has affected other land to the north in Kepa Drive although this has been associated with volcanic soils overlying the Waitemata Group deposits. The presence of volcanic materials overlying the Waitemata Group has not been confirmed as a cause of the movement that has occurred in the past. In general terms we would expect however that given the scale of development a combination of excavation, deep foundations and drainage can be used to create stable building platforms for the proposed structures. The details of such works will however require additional geotechnical data across the site and extending to a depth not carried out to support the residential subdivision.

In our opinion to support the detailed design of the proposed development at least two phases of investigation should be undertaken. We consider an initial phase of investigation should be carried out to confirm the depth at which prior movement has occurred. The scope of that initial phase should in our opinion obtain sufficient data to make a preliminary assessment of the potential costs for foundations as well as options and costs for short and long term support/stabilisation measures to assist in a feasibility assessment. We consider that 6 – 7 machine boreholes extending 10 – 30m below existing ground level, with associated laboratory testing and analyses will be required to support such preliminary geotechnical design input. Further investigations are however likely to be required to support detailed planning and design. Such work may more than double the number of machine boreholes in the initial phase to provide adequate data on pile founding levels, groundwater levels and so on.

In the event extensive preshearing of materials is evident in the recovered core, and a large area of disturbed material is identified appropriate laboratory testing including both direct shear and triaxial testing may be required to confirm design shear strength parameters for stability analyses and foundation design. The extent and relative benefit of laboratory testing and

subsequent analysis will be affected by the depth at which prior movement has occurred and the inferred factor of safety against movement at present, based on the groundwater levels identified across the site. The actual extent of the zone known to be affected by the previous construction of counterfort drainage (understood to have extended 9m below ground level), is also likely to affect the assessment of practical limitations and construction cost.

Preliminary evaluation of borehole data can be expected to influence the extent and cost of laboratory work, analyses and ultimately the reporting appropriate to support preliminary design. The results of the testing and analyses will however together with the development of the design from concept to preliminary/developed design assist in the definition of any further investigations required to support detailed design and to provide suitable information for use in construction monitoring. We consider the detailed laboratory testing and analysis now allowed for should provide the bulk of the data necessary for detailed design. We note however that ultimately more than 10 – 12 machine boreholes may be necessary, (to provide borehole data for each multi-storey structure), and to support the design of a staged development that extends south along the site.

We note that, subject to confirmation by the investigations outlined above, it is our opinion the development as proposed is unlikely to be precluded on technical grounds. The results of the geotechnical investigations may however significantly affect the cost of construction. We trust this information is sufficient for your present purposes. Should you have any queries regarding this information please contact the writer.

Yours faithfully

**Babbage Consultants Limited**



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Encl Copies of the Concept Plan prepared by LA4 and the artists impression by Zhong