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Cabra Holdings Ltd
C/- Blue Wallace Surveyors Ltd
PO Box 38
Hamilton

Attention: Tony Tynan

4 October 2007

Dear Tony

Hampshire Court Subdivision, River Road, Hamilton: NZS 4404:2004 Schedule 2A Completion Report

In accordance with your instructions, a post completion geotechnical investigation has been undertaken for Hampshire Court Subdivision in north Hamilton. The investigations support the attached "*Statement of Professional Opinion as to the Suitability of Land for Building Construction*" (ie the NZS 4404:2004 Schedule 2A Certificate).

1.0 Background

The Hampshire Court Subdivision is bounded by St Petersburg Subdivision to the north and east, Woodridge subdivision to the south and an existing residential subdivision to the west. The fully developed subdivision will consist of 25 residential lots.

The Hampshire Court Subdivision is accessed off Te Huia Drive which is a collector road on the north eastern side of the subdivision. The land form on which Hampshire Court subdivision is located was generally very gently undulating and so only minor earthworks were undertaken during the construction of the subdivision. Prior to development the property was in cultivation and/or pasture.

2.0 Geological Description of the Land

Geologically, the landform on which the Hampshire Court residential development is located is an old river terrace. The soils underlying the subdivision consist of the Hinuera Formation, ie alluvial sediments (pumiceous sand, silt and gravel interbedded with lenses of peat) which were deposited by the Waikato River over thousands of years. The river has subsequently become entrenched in a well defined gully resulting in the formation of near level river terraces either side of the gully.

3.0 Subdivision Earthworks

In general terms, earthworks undertaken during the construction of the subdivision consisted of minor cuts and fills to form a near level site for the lots.

In detail, the earthworks undertaken as part of construction of the subdivision development consisted of the following:

- Placement of controlled fill to a maximum depth of 0.6m to 0.7m on lots 1 to 7 to infill a broad shallow depression.
- Placement of controlled fill on all or parts of lots 13, 14, 15, 19, 20, 21, 22, 23, 24 and 25 to a depth of 0.2m to 0.3m to infill an isolated shallow depression.

- Cuts to a maximum depth of 0.6m (but generally between 0.2m to 0.4m) on all or parts of lots 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22 and 23 to remove several low knolls. The excavated silt or clayey silt material was used as the controlled fill in the low lying areas noted above.
- Excavations to form the road network and the trenches in which the stormwater, power, water, gas and sewerage services are located.

All controlled filling undertaken by the developer was completed in accordance with NZS 4431:1989 "*Earth Fill for Residential Development*". All vegetation, topsoil and near surface organic soils were removed from the areas to be filled prior to the controlled fill being placed.

4.0 Ground Investigations

Ground conditions across The Hampshire Court Subdivision were investigated during late August 2007 by machine augered drillholes with accompanying scala penetrometer tests to a depth of between 3.0m to 5.0m below ground level on each of the 25 lots. Logs of the materials encountered in the drillholes and the soil strengths are attached.

Based on the drillhole results and our experience with similar subsoils in the area, subsurface conditions on the lots in Hampshire Court generally consist of 0.1m to 0.3m of dark brown silt (topsoil) overlying alternating layers of moist silt, sandy silt, silty fine sand and fine to medium sand to a depth of at least 5.0m below ground level.

The alluvial sediments underlying the site are typically moist and the soil densities are generally slightly loose near the surface, increasing to medium dense with increasing depth. As a general rule, the near surface silt layers were looser than the underlying sandy silt or fine to medium sand layers as inferred from the scala penetrometer soil test data.

The exceptions to the general soil conditions noted above are that on lots 1, 2, 3, 4, 5, 6 and 7 silty clay controlled fill was placed to a depth of between 0.2m to 1.5m below finished ground level.

The soils strength tests on the lots indicate that the soils generally have sufficient density to provide the required 300 kPa ultimate foundation bearing capacity for standard residential development in accordance with NZS 3604:1999 but the depth to solid ground varied from a depth of 0.3m to 1.2m. As a general statement, the near surface soils underlying the lots on the southern and central areas of the subdivision were denser than the soils on the northern side of the property.

Static groundwater level (the ground watertable) is interpreted as being at a depth of at least 3m below ground level at the date of testing (Late August 2007).

5.0 Building Development Recommendations

Based on the results to date and subject to the recommendations in this report, the lots in Hampshire Court subdivision are considered suitable for residential development in accordance with NZS 3604:1999 "*Timber Framed Buildings*". However, due to the near surface soils being loose in some areas, excavations to remove the loose soils followed by the placement of controlled fill will be required where the near surface soils are not able to provide an ultimate foundation bearing pressure of 300 kPa.

To provide guidance on the soil strengths and foundation systems recommended for each lot in Hampshire Court, the following table has been prepared.

The foundation recommendations detailed in the attached table are based on the assumption that the foundations for the proposed dwellings on each lot will be formed at a minimum depth of 0.3m below current ground level. If basement type foundations are proposed (which is very unlikely on this subdivision due to the near level topography), then additional soil tests will need to be carried out to

confirm that the required 300 kPa ultimate bearing pressure is available at the underside of the basement foundations.

5.1 Hampshire Court Foundation Recommendations

The machine augered drillholes and scala penetrometer tests undertaken to date indicate that the soils from a depth of approximately 0.3m to 0.4m below ground level are generally adequate for 300 kPa ultimate bearing except for the lots on the northern side of the subdivision where the depth to solid ground is 1.2m below ground level in places. It is all possible that on some lots excavations to depths greater the values tabulated below may be required under the load bearing footing lines to remove isolated soft pockets of soil.

The foundation system recommended for each lot is based on 1 soil test completed near the centre of each lot and so we recommend that prior to commencing the foundation works on each house, a detailed soils investigation is undertaken on each lot and the foundation system required to support the proposed house designed accordingly.

The controlled fill depths noted below are from finished ground level to the underside of the fill layer and so include the depth of the topsoil layer placed on top of the fill layer.

In addition, excavations to form the foundation sand pads that are undertaken in wet weather may result in excavation depths exceeding the depths noted below if the silt and sandy silt subgrade soils are softened by rainwater ponding on the sites.

Foundation Recommendations for the Hampshire Court Lots					
Lot No.	Controlled Fill Depth	Depth to 300 kPa Ultimate Bearing Capacity	Likely Foundation System	Minimum Foundation Excavation Depth	Design Ultimate Foundation Bearing Pressure
1	0.5m	0.3m	Concrete slab on sand pad	0.3m	300 kPa
2	0.7m	0.3m	Concrete slab on sand pad	0.3m	300 kPa
3	0.5m	0.3m	Concrete slab on sand pad	0.3m	300 kPa
4	0.8m	0.3m	Concrete slab on sand pad	0.3m	300 kPa
5	0.8m	0.3m	Concrete slab on sand pad	0.3m	300 kPa
6	0.8m	0.3m	Concrete slab on sand pad	0.3m	300 kPa
7	0.5m	0.3m	Concrete slab on sand pad	0.3m	300kPa
8	-	0.6m	Concrete slab on sand pad	0.6m	300 kPa
9	-	0.3m	Concrete slab on sand pad	0.3m	300 kPa
10	-	0.9m	Concrete slab on sand pad	0.6m to 0.9m	300 kPa
11	-	0.3m	Concrete slab on sand pad	0.3m	300 kPa
12	-	1.2m	Concrete slab on sand pad	1.2m	300 kPa
13	-	0.6m	Concrete slab on sand pad	0.6m	300 kPa
14	-	0.3m	Concrete slab on sand pad	0.3m	300 kPa
15	-	0.9m	Stiffened Concrete slab on sand pad	0.3m	150 kPa
16	-	0.3m	Concrete slab on sand pad	0.3m	300 kPa
17	-	0.3m	Concrete slab on sand pad	0.3m	300 kPa
18	-	0.3m	Concrete slab on sand pad	0.3m	300kPa

Lot No.	Controlled Fill Depth	Depth to 300 kPa Ultimate Bearing Capacity	Likely Foundation System	Minimum Foundation Excavation Depth	Design Ultimate Foundation Bearing Pressure
19	-	0.9m	Concrete slab on sand pad	0.9m	300 kPa
20	0.3m	0.9m	Stiffened Concrete slab on sand pad	0.3m	150 kPa
21	-	0.3m	Concrete slab on sand pad	0.3m	300 kPa
22	0.5m	0.9m	Concrete slab on sand pad	0.9m	300 kPa
23	-	0.9m	Concrete slab on sand pad	0.9m	300 kPa
24	-	1.2m	Concrete slab on sand pad	1.2m	300 kPa
25	-	1.2m	Concrete slab on sand pad	1.2m	300kPa

6.0 Conclusions

Based on the investigations undertaken to date and subject to the development recommendations contained in this report, the land designated as The Hampshire Court Subdivision is considered suitable for residential development in accordance with NZS 3604:1999. The following recommendations are given to **guide** building construction on the lots, but additional detailed soils investigations on each lot are recommended prior to designing the appropriate foundation system.

- 6.1** Those lots where the ultimate bearing pressure is less than 300 kPa (ie lots 15 and 20) can have the proposed houses supported on either a stiffened floor slab (if a minimum of 225 kPa is available) or a RibRaft floor slab (if a minimum of 150 kPa is available).
- 6.2** For the balance of the lots an ultimate foundation bearing pressure of 300 kPa is available at a depth of between 0.3m to 1.2m below ground level. A standard concrete slab foundation supported on a sand pad can be used to support the proposed houses on these lots.
- 6.3** Specific hand auger and scala penetrometer tests are recommended on all lots prior to development to confirm the foundation recommendations provided above are appropriate.

A Statement of Professional Opinion as to the Suitability of Land for Building Construction (ie the NZS 4404:2004 Schedule 2A Certificate for the Hampshire Court Subdivision) is attached.

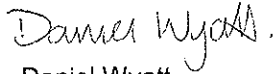
7.0 Limitations

The recommendations and options contained in this report are based on data from the field investigations described above. Inferences about the nature and continuity of ground conditions away from test locations are considered reasonable, but cannot be guaranteed.

During development of the lots, a person competent to assess should examine ground conditions exposed in foundation excavations and cuttings to confirm whether the conditions are compatible with the assumptions made in this report. In all circumstances, if ground conditions differ from those described in this report the matter should be referred to a geotechnical engineer. This professional opinion **does not** remove the requirement for the normal inspection and verification of foundation conditions for all buildings constructed on the lots.

This report has been prepared for the particular project described in the owner's brief to us. No responsibility is accepted for the use of any part of this report in other contexts or for any other purposes.

Yours faithfully



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Ref: 600 07598/Schedule 2A Completion Reports/Stages 5-6



Colin Jacobson
Engineering Manager

encl: Location Plan & Drillhole Logs/Schedule 2A Certificate/Cut Fill Plan

cc: File

SCHEDULE 2A

STATEMENT OF PROFESSIONAL OPINION AS TO SUITABILITY OF LAND FOR BUILDING CONSTRUCTION

Development Hampshire Court Subdivision

Developer Cabra Holdings Ltd

Location River Road, Hamilton

I, Colin Barry Jacobson
(Full Name)

of Maunsell Ltd, PO Box 434, Hamilton

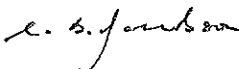
Hereby confirm that:

1. I am a geotechnical engineer as defined in section 1.2.3 of NZS 4404 and was retained by the developer as the geotechnical engineer on the above development.
2. The extent of my inspections during construction, and the results of all tests carried out are described in my geotechnical completion report dated 4 October 2007.
3. In my professional opinion, not to be construed as a guarantee, I consider that *(delete as appropriate)*:
 - (a) The earth fills shown on the attached Blue Wallace Surveyors Ltd Plan No. 05/208 have been placed in compliance with the requirements of the Hamilton City Council and my specification.
 - (b) The completed works give due regard to land slope and foundation stability considerations.
 - (c) The original ground not affected by filling is suitable for the erection thereon of buildings designed according to NZS 3604 provided that:
 - (i) Those lots where the ultimate bearing pressure is less than 300 kPa (ie lots 15 and 20) can have the proposed houses supported on either a stiffened floor slab (if a minimum of 225 kPa is available) or a RibRaft floor slab (if a minimum of 150 kPa is available)
 - (ii) For the balance of the lots an ultimate foundation bearing pressure of 300 kPa is available at a depth of between 0.3m to 1.2m below ground level. A standard concrete slab foundation supported on a sand pad can be used to support the proposed houses on these lots
 - (iii) Specific hand auger and scala penetrometer tests are recommended on all lots prior to development to confirm the foundation recommendations provided above are appropriate
 - (d) The filled ground is suitable for the erection thereon of buildings designed according to NZS 3604 provided that:
 - (i) Those lots where the ultimate bearing pressure is less than 300 kPa (ie lots 15 and 20) can have the proposed houses supported on either a stiffened floor slab (if a minimum of 225 kPa is available) or a RibRaft floor slab (if a minimum of 150 kPa is available)
 - (ii) For the balance of the lots an ultimate foundation bearing pressure of 300 kPa is available at a depth of between 0.3m to 1.2m below ground level. A standard concrete slab foundation supported on a sand pad can be used to support the proposed houses on these lots
 - (iii) Specific hand auger and scala penetrometer tests are recommended on all lots prior to development to confirm the foundation recommendations provided above are appropriate
 - (e) The original ground not affected by filling and the filled ground are not subject to erosion, subsidence or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991 provided that:
 - (i) Those lots where the ultimate bearing pressure is less than 300 kPa (ie lots 15 and 20) can have the proposed houses supported on either a stiffened floor slab (if a minimum of 225 kPa is available) or a RibRaft floor slab (if a minimum of 150 kPa is available)
 - (ii) For the balance of the lots an ultimate foundation bearing pressure of 300 kPa is available at a depth of between 0.3m to 1.2m below ground level. A standard concrete slab foundation supported on a sand pad can be used to support the proposed houses on these lots
 - (iii) Specific hand auger and scala penetrometer tests are recommended on all lots prior to development to confirm the foundation recommendations provided above are appropriate

NOTE: The sub-clauses in clause 3 may be deleted or added to as appropriate.

4. This professional opinion is furnished to the TA and the developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any dwelling.

5. This certificate shall be read in conjunction with my geotechnical report referred to in clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

Signed: 
NZCE, BE (Hons), MIPENZ

Date: 3 October 2007