

Cabra Developments Limited
Geotechnical Completion Report
Beachwood Estates Stage 2BD
Hatfields Beach
25 October 2013



Trust is the
cornerstone
of all our
projects



25 October 2013

Cabra Developments Limited
PO BOX 197
Orewa

Attention: Mr. L. Barker

Dear Lloyd

RE: Geotechnical Completion Report for Beachwood Estates Stage 2BD at Beachwood Drive, Hatfields Beach

This report presents all supporting geotechnical data and our Suitability Statement in relation to land development works undertaken at the above location.

It has been prepared in accordance with instructions received from Wood and Partners Limited and forms part of the documentation required by Auckland Council to achieve certification under Section 224(c) of the Resource Management Act.

If you have any queries or you require any further clarification on any aspects of this report, please do not hesitate to contact the undersigned.

For and on behalf of Coffey Geotechnics (NZ) Ltd

A handwritten signature in black ink, appearing to read "Greg Snook", with a horizontal line underneath.

Greg Snook

Engineering Geologist

Attachment A: Attachments

Distribution: Original held by Coffey Geotechnics (NZ) Ltd
3 hard copies and electronic copy to Wood and Partners Limited
1 hard copy to Cabra Developments Limited

Coffey Geotechnics (NZ) Limited
First Floor, 65-69 Forge Road Silverdale 0932 New Zealand
PO Box 256 Orewa 0946 New Zealand
T (+64) (9) 426 9707 F (+64) (9) 426 9709 coffey.com

GENZSILV13847AA-AS

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1 INTRODUCTION AND DESCRIPTION OF SUBDIVISION

This Geotechnical Completion Report has been prepared for Cabra Developments Limited as part of the documentation required to be submitted to Auckland Council following residential subdivisional development.

It contains our Suitability Statement, relevant test data and the Wood and Partners Limited (Woods) as-built plan set relating to Stage 2BD of the Beachwood Estates Residential Subdivision as follows:

TABLE 1: WOOD AND PARTNERS LIMITED AS-BUILT PLANS

Title	Reference No.	Date
As-built Final Contour Plan	60354-2BD-100-AB REV.A	September 2013
As-built Cut and Fill Depth Contour Plan	60354-2BD-120-AB REV.A	September 2013
As-built Undercut, Subsoil Drain & Palisade Wall Plan	60354-2BD-121-AB REV.C	October 2013
As-built Retaining Wall Plan	60354-2BD-130-AB REV.B	October 2013
Overall As-built Retaining Wall Restriction Zone Plan	60354-2BD-131-AB REV B	October 2013
As-built Retaining Wall Restriction Zone Plan 1	60354-2BD-132-AB REV A	October 2013
As-built Retaining Wall Restriction Zone Plan 2	60354-2BD-133-AB REV A	October 2013
As-built Retaining Wall Restriction Zone Plan 3	60354-2BD-134-AB REV A	October 2013
Overall As-built Batter Restriction Zone Plan	60354-2BD-140-AB REV B	October 2013
As-built Batter Restriction Zone Plan 1	60354-2BD-141-AB REV A	October 2013
As-built Batter Restriction Zone Plan 2	60354-2BD-142-AB REV A	October 2013
As-built Batter Restriction Zone Plan 3	60354-2BD-143-AB REV A	October 2013
Roading and Street Tree As-built Plan	60354-2BD-RD-200-AB REV.A	September 2013
Roading and Street Tree As-built Plan	60354-2BD-RD-201-AB REV.A	September 2013
Roading and Street Tree As-built Plan	60354-2BD-RD-202-AB REV.A	September 2013
Roading and Street Tree As-built Plan	60354-2BD-RD-203-AB REV.A	September 2013
Typical Road Details As-built Plan	60354-2BD-RD-250-AB REV.A	September 2013
Typical Road Details	60354-2BD-RD-251-AB REV.A	September 2013

As-built Stormwater Plan	60354-2BD-DR-380-AB REV.A	September 2013
As-built Stormwater Plan	60354-2BD-DR-381-AB REV.A	September 2013
As-built Stormwater Plan	60354-2BD-DR-382-AB REV.A	September 2013
As-built Stormwater Plan	60354-2BD-DR-383-AB REV.A	September 2013
As-built Wastewater Plan	60354-2BD-390-AB REV.A	September 2013
As-built Wastewater Plan	60354-2BD-391-AB REV.A	September 2013
As-built Wastewater Plan	60354-2BD-392-AB REV.A	September 2013
As-built Wastewater Plan	60354-2BD-393-AB REV.A	September 2013
As-built Watermain Plan	60354-2BD-600-AB REV.A	September 2013
As-built Watermain Plan	60354-2BD-601-AB REV.A	September 2013
As-built Watermain Plan	60354-2BD-602-AB REV.A	September 2013
As-built Watermain Plan	60354-2BD-603-AB REV.A	September 2013

This report covers the construction period from December 2011 to October 2013. It is intended to be used for certification purposes for lots on DP 456159 as follows:

- 31 residential lots numbered 1 to 25, 39 to 42, 61 and 62;
- 2 extensions to existing roads named Beachwood Drive and Seaview Crescent;
- 2 jointly owned access lots numbered JOAL 1 and JOAL 2;
- 1 recreation reserve;

This stage of the subdivision is located at Beachwood Drive, Hatfields Beach and as can be seen on the fill as-built plan, a total of 21 of the lots have been partly or totally affected by filling, to a maximum depth of approximately 7.5 metres.

2 RELATED REPORTS

Investigation and design works were undertaken for the entire stage 2 area in 2011, and a preliminary report including the investigation and design information was prepared for Resource Consent Application, referenced GENZSILV13847 and dated 8 August 2011. A further design report was prepared for Beachwood Stage 2, referenced GENZSILV13847, dated 16 January 2012 covering construction of earthworks and geotechnical remediation within Stage 2.

Stages 2AC and 2C have previously been certified in Coffey reports referenced GENZSILV13847AA-AL and GENZSILV13847AA-AP.

The conclusions and recommendations of these reports have been reviewed during the preparation of this document.

3 EARTHWORKS OPERATIONS

3.1 Plant

The items of construction plant used on site during the operations are as follows:

Hick Bros Civil Construction Limited

1 x D7 & Scoop
1 x D6 with blade and towed roller
1 x 4WD Sheep's Foot Compactor
1 x Watercart
1 x Motorscraper
1 x Tractor with Rear Disks
1 x 20T Excavator
1 x 5T Excavator
1 x Bobcat
1 x 5T Loader
1 x 5T Dump Truck

ICB Construction Limited (retaining walls)

1 x 7.5T Excavator
1 x 10T Excavator
1 x Backhoe Loader
1 x 20T Excavator

Matakana Drainage Limited (drainage)

1 x 20T Excavator
1 x 12T Excavator
1 x 5T Bobcat

Mulchit Limited (landscaping)

1 x Front End Loader
1 x Mulching Spreader Truck

Hiway Stabilizers Limited (soil moisture conditioning)

1 x Lime Spreader
1 x Lime Hoe

3.2 Construction Programme

Prior to March 2012, vegetation removal and limited topsoil stripping was undertaken within the stage 2BD area in conjunction with works on earlier stage areas.

Pre-construction drilling for eastern palisade wall was carried out between mid-March and April 2012. During this time, counterfort drains were constructed within the reserve area adjacent to the eastern palisade wall site near the eastern boundary (adjacent to 37 Sun Valley). The counterfort drains were laid within the two gully formations in the west. Construction of the eastern palisade wall was undertaken during the month of May 2012.

During May 2012 through to October 2012 the majority of the works being carried out within Beachwood Subdivision were undertaken on Stages 2AC and 2C, and included construction of the permanent stormwater pond and civil works to finish these subdivision stages.

Earthwork restarted within Stage 2BD in October 2012 when cut and fill operations were carried out to form a Silt Retention Pond in the reserve area adjacent to Lot 62 (within the cut/fill boundary). Also during this time stripping and fill operations began to form the batter slope in the reserve area above the eastern palisade wall using a combination of stabilised and un-stabilised clay fill materials. Works to form this batter slope continued towards the west throughout November 2012.

Retaining wall construction along lot boundaries within this stage began in mid October 2012 and continued through to April 2013. Construction of these walls was carried out by subcontractor ICB Construction Limited.

Construction of the western palisade wall was undertaken throughout early to mid January 2013.

Construction of sanitary sewer and stormwater drainage within this stage of the subdivision began in late February 2013. Some of the service lines required additional drainage within the pipe bedding to capture groundwater seepages observed within the service trench works.

During March 2013 the batter slope on the south western side of this stage was topsoiled following completion of cuts and fills to form finished gradients here. During this time timber retaining wall construction continued throughout this stage.

In late April 2013 following a period of inclement weather, movement of an area of topsoil downslope of the western palisade wall occurred. Further rain caused the movement to continue within the upper 300mm to 500mm of natural soils during early May. The slip area was remediated during mid May 2013 to early June 2013 under guidance of Coffey staff and included drainage placed on the downslope side of the palisade wall.

Civil works to finish this stage of the subdivision including subgrade preparation, concrete works, kerb and channel construction and topsoiling works between mid June 2013 to October 2013. During this time Coffey staff undertook subgrade testing of the road extensions and site inspections to observe preparation of roading, removal of temporary silt retention ponds and flushing of counterfort drains within this stage.

4 QUALITY ASSURANCE AND CONTROLS

4.1 Inspections

During the earthworks engineering inspections were undertaken on a regular basis to assess compliance with NZS 4431 and our project specific recommendations and specifications. Project specific inspections were required on this stage of the development for:

- gully areas prior to the placement of fill materials to ascertain that all mullock and soft inorganic subsoils had been removed to our satisfaction;
- installation of underfill drains and scoria blankets;
- counterfort drain excavations to confirm depths, ground conditions, drain coil placement and backfilling;
- subsoil drain connections to outlets and flushing at the completion of the works;
- silt traps and temporary ponds prior to backfilling to ensure that all silt had been removed and that the sides of the excavation were benched where necessary;

- retaining wall pile hole excavations and drainage placement;
- construction of palisade walls, including ground conditions, pile size, pile spacing, pile hole size, depths and groundwater monitoring and founding materials in accordance with the design documents.

4.2 Quality Control Criteria

Due to the widely varying soil types being used as filling, the compaction control criteria of minimum allowable shear strength and maximum allowable air voids were mainly used for quality assurance purposes.

Specification details were as follows:

TABLE 2: COMPACTION CONTROL CRITERIA

Minimum Shear Strength and Maximum Air Voids Method		
(a)	<u>Air Voids Percentage</u>	
	(As defined in NZS 4402)	
	Average value less than	10%
	Maximum single value	12%
(b)	<u>Undrained Shear Strength</u>	
	(Measured by Pilcon shear vane - calibrated using NZGS 2001 method)	
	Average value not less than	140 kPa
	Minimum single value	110 kPa

4.3 Quality Assurance Testing

Regular in situ density, strength and water content tests were carried out on all areas of the filling at/or in excess of the frequency recommended by NZS 4431.

Control tests carried out on the filling showed that on a few occasions the required compaction standards were not being achieved. Results of the test failures were relayed to the site foreman and/or his staff, and to the best of our knowledge the affected areas of fill were re-worked as necessary. In each case, further testing was carried out until compliance with the standards was achieved.

5 PROJECT EVALUATION

5.1 Bearing Capacity and Settlement of Building Foundations

Following the completion of earthworks operations, we returned to the site on several occasions and drilled a series of hand auger boreholes at appropriate natural ground locations in order to determine representative finished ground conditions and hence evaluate likely foundation options for future building development. The resulting bearing capacity recommendations are presented in the appended Suitability Statement.

At current subgrade levels all lots within Stage 2BD have a geotechnical ultimate bearing capacity of 300 kPa within the influence of conventional shallow residential building foundation loads. At these bearing pressures differential settlements due to building loads should be within code limits.

Where a geotechnical ultimate bearing capacity greater than 300 kPa is required, further specific site investigation and design of foundations should be carried out prior to building consent application.

It should be noted that NZS 3604 only allows a maximum backfill depth of 600mm over the building platform of a dwelling unless an Engineering design solution is proposed, on account of the risk of induced consolidation of the subsoils caused by the weight of the backfill.

5.2 Expansive Soils

Three sets of Expansive soil tests were carried out on samples selected from around the site and within the zone of likely influence of shallow building foundations.

These limit tests were carried out in accordance with NZS 4402, "Methods of Testing Soils for Civil Engineering Purposes" test section 2 and were primarily intended to assess the Expansive Classes of the site materials as defined in AS 2870, "Residential Slabs and Footings – Construction".

All test results are IANZ (International Accreditation New Zealand) endorsed and full details are appended.

The AS 2870 Site Class for this stage of the subdivision is S (slight). Specific design alternatives for this Site Class are presented in the Suitability Statement.

5.3 Lot Gradients

Stability conditions at this site have been enhanced by the construction retaining walls, palisade walls and the installation of counterfort drains as described above.

The appended Batter Restriction Zone Plans shows areas having gradients steeper 1 in 4 or being adjacent to land having such gradients. The extent of these areas has been determined by site gradients and our final walkover inspection, but there may be localised areas having such gradients that have not been shown on the plans.

Details of resulting building and earthworks restrictions within the vicinity of these areas are presented in the Suitability Statement.

5.4 Fill Induced Settlement

As a result of our pre-gully fill inspections, the installation of counterfort drainage and quality control testing, we are of the opinion that induced differential settlements beneath or within the certified filling due to its imposed weight should be insignificant with respect to conventional NZS 3604 residential building development that incorporates specific foundation and associated structural design on account of the expansive soils site class.

5.5 Vegetation Cover

Wherever practical on sloping land beyond building platform areas any existing bush and grass cover should be maintained and even supplemented with new plantings. Any vegetation cleared beyond the

immediate area of building platforms for temporary construction purposes should be replaced as soon as possible.

The contribution of appropriate vegetation cover to overall site stability and erosion control should not be underestimated.

5.6 Stormwater Controls

It is important on all sloping lots that due care is paid to the design and construction of appropriate stormwater disposal systems. These systems should serve to collect all runoff from roofs, decks and paved areas, together with discharges from retaining wall drains and other subsoil drains and should connect directly into the public stormwater drainage network.

Uncontrolled stormwater discharges onto the ground surface or into soakage pits can cause erosion, scour and/or instability on sloping land and should not be permitted under any circumstances where stability could be compromised.

5.7 Service Trenches

As is normal on all subdivisions, building developments involving foundations within a 45 degree zone of influence from pipe inverts will require engineering input.

Areas within lot 1 to 6 and 17 to 25 are known to have service trenches within the lots as shown on the appended Stormwater As-built plans. The resulting restrictions are contained in the Suitability Statement.

5.8 Counterfort Drains

The appended As-built Undercut, Subsoil Drain & Palisade Wall Plan show the positions of counterfort drains that were constructed up gully formations. These drains were provided to help control groundwater levels in the area, and are linked into the stormwater reticulation, as shown on the appended plan.

Typical trench excavation depths were 3 to 7 metres. Where they pass beneath fill areas, the drains were installed prior to filling. In cut areas they were installed following the excavation to finished levels.

Details of resulting building restrictions are presented in the Suitability Statement.

5.9 Road Subgrades

Penetration resistance tests were undertaken on the road subgrades during mid- to late-June 2013 and the results were subsequently forwarded to Woods Limited for pavement design purposes. Areas demonstrating low equivalent CBR values were generally undercut and compacted to achieve appropriate standards and to allow for a reduction in sub-base metal depths.

5.10 Retaining Walls

Some areas of the site have been stabilised by the construction of boundary retaining walls in the locations shown on the As-built Retaining Wall Plans. These walls reach a maximum height of approximately 3.3 metres and were designed by Ian Hutchinson Consultant Limited. The ground conditions exposed in the pile holes, and the structural and drainage elements of these walls during

construction were inspected by this Consultancy. A copy of our Producer Statement - Construction Review is appended.

Details of resulting building and earthworks restrictions within the vicinity of these walls are presented in the Suitability Statement.

5.11 Topsoil

Topsoil depths in likely building platform areas were checked by the drilling of a borehole in the approximate centre of each residential lot. Our findings, which are indicative only and subject to variation at other locations, show that likely topsoil depths are between 120 mm and 300 mm. Site specific findings are presented in the Suitability Statement Summary.

5.12 Contractor's Work

We have reasonably relied on the Contractor's work practices and assume that the works have been carried out in accordance with:

- (i) The approved Contract drawings and design details,
- (ii) The approved Contract specifications,
- (iii) Authorised Variations to (i) and (ii) during the execution of the works,
- (iv) The conditions of Resource, Earthworks and Building Consents where applicable,
- (v) The relevant Coffey Geotechnics reports, recommendations and site instructions,

and that all as-built information and other details provided to the Client and/or Coffey Geotechnics are accurate and correct in all respects.

6 STATEMENT OF PROFESSIONAL OPINION AS TO THE SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

I, R. J. Knowles, of Coffey Geotechnics (NZ) Limited, Auckland, hereby confirm that:

1. I am a Chartered Professional Engineer experienced in the field of geotechnical engineering as defined in section 1.2.3 of NZS 4404 and was retained by the Developer as the Geotechnical Engineer on Stage 2BD of the Beachwood subdivision.
2. The extent of preliminary investigations carried out to date are described in Coffey report GENZSILV13847 dated 8 August 2011. A further design report was prepared for Beachwood Stage 2, referenced GENZSILV13847, dated 16 January 2012. The conclusions and recommendations of those documents have been re-evaluated in the preparation of this report.

The results of all tests undertaken during construction are appended.
3. In my professional opinion, not to be construed as a guarantee, I consider that:
 - (a) The earth fills shown on the appended as-built cut and fill depth contour plan have been placed in compliance with NZS 4431, the Legacy Rodney District Council District Plans and related documents.

- (b) The completed earthworks give due regard to land slope and foundation stability considerations within the residential lots, but as shown on the appended Batter Restrictions Zone Plans, areas on lots 1 to 15, 21 to 25, 39 to 41, 61 and 62 inclusive have gradients steeper than 1 in 4 or are adjacent to land having such gradients accordingly, batter set-backs incorporating **Specific design zones** and/ or **leading edge piling zones** have been applied.

No building construction and no earthworks shall take place within the designated **specific design zone areas** or elsewhere if similar gradients exist unless endorsed by a Chartered Professional Engineer experienced in geomechanics, as such operations may, in certain circumstances, have detrimental effects on overall site stability.

Building Development within designated **leading edge pile zones** will need to be piled to account for a 1 metre deep soil creep zone/ lateral load. Accordingly, the piles should be designed in shear and bending to resist an 'at-rest' lateral soil load equivalent to 3 pile diameters applied to a depth of 1 metre. The minimum pile depth within this zone should be 2 metres. The following design parameters may be assumed:

ϕ' = 30 degrees

S_u = 100 kPa

Geotechnical ultimate end bearing capacity beyond 1.8 metres depth = 450 kPa.

Ultimate side adhesion beyond 1.0 metres depth = 25 kPa. Ignore side adhesion in the top 1.0 metres.

The structural designer should attend to the details of pile type, spacing, diameter and load capacity and must also ensure that the design allows for differential movement that may occur between the piled and un-piled portions of any building.

- (c) The function of the counterfort drains installed on lots 1 to 8 should not be impaired by any building development or landscaping works. In particular, any bored or driven piles must be positioned to avoid damaging the counterfort drains. Where these drains pass beneath potential building platform areas on lots 6 and 7, they are covered by in excess of 5 metres of engineered filling and accordingly are not required to be specifically addressed for shallow foundation design here.
- (d) A geotechnical ultimate bearing capacity of 300 kPa may be assumed for shallow foundation design on all lots.

Where a geotechnical bearing capacity greater than 300 kPa is required, (ie outside the limits of NZS 3604, such as when piling is undertaken), further specific site investigation and design of foundations should be carried out prior to building consent application.

- (e) The backfilling and compaction of the stormwater and sanitary sewer trenches on this subdivision has where possible been carried out to appropriate standards having regard for the prevailing ground conditions and associated compaction induced pipe loadings.

Nevertheless, no building development should take place within the 45 degree zone of influence of drain inverts unless endorsed by specific site investigations, foundation designs and by construction inspections undertaken by a Chartered Professional Engineer experienced in geomechanics to ensure that lateral stability and differential settlement issues are addressed and that building loads are transferred beyond the influence of the pipe and beyond the extent of the trench backfill.

This requirement is most likely to impact on areas adjacent to the stormwater lines that lie inside boundaries of lots 1 to 6 and 17 to 25.

- (f) No building construction, including the construction of additional retaining walls and no earthworks should take place within designated retaining wall restriction zones adjacent to the retaining walls on lots 4 to 25, 39 to 42, 61 and 62 inclusive unless endorsed by specific designs and by construction inspections undertaken by a Chartered Professional Engineer experienced in geomechanics to ensure that no additional loads are applied to the walls. Specific site investigation should not be required.
 - (g) The assessed AS 2870 expansive site Class for all lots is S (Slight).
 - (h) Subject to the geotechnical limitations, restrictions, recommendations and expansive soil assessments associated with 3(b), 3(c), 3(d), 3(e), 3(f), and 3(g) above:
 - (i) The filled and undisturbed original ground within residential lot boundaries is generally suitable for residential buildings constructed in accordance with NZS 3604 (that incorporates specific foundation and associated structural design on account of the expansive soils site class) and related documents.
 - (ii) On all lots, foundation design may be carried out in accordance with AS 2870 (Class S) or alternatively, a specific foundation and structural design may be undertaken by a Chartered Professional Engineer who should allow for expansive soil effects in the design. In this latter case, the minimum foundation depth below cleared ground level following topsoil removal and benching of building platform areas is 450mm for NZS3604 type shallow strip and pad foundations.
4. Road subgrades and lot accessway subgrades have been formed having due regard for slope stability and settlement, although CBR values do vary between natural and filled ground as is to be expected.

The appended table summarises the status of each residential lot covered by this Suitability Statement.

The professional opinion contained within this report is furnished to the Auckland Council and Cabra Developments Limited for their purposes alone on the express condition that it will not be relied upon by any other person.

Prospective purchasers should still satisfy themselves as to any specific conditions pertaining to their particular land interest.

For and on behalf of Coffey Geotechnics (NZ) Limited



Richard Knowles

Principal Geotechnical Engineer, CPEng

Prepared By:



Greg Snook

Engineering Geologist

Reviewed By:

TABLE 4: SUITABILITY STATEMENT

Lot No.	Comments	Topsoil Depth (mm)	Ultimate Bearing (kPa)	AS2870 :2011 Class
1	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Service line within lot (refer clause 6.3(e)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	120	300	S
2	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Service line within lot (refer clause 6.3(e)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	130	300	S
3	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Service line within lot (refer clause 6.3(e)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	170	300	S
4	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	200	300	S
5	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
6	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
7	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	250	300	S
8	Batter specific design zone restrictions (refer clause 6.3(b)) Counterfort drain restriction (refer clause 6.3 (c)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	250	300	S
9	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	120	300	S

GEOTECHNICAL COMPLETION REPORT FOR BEACHWOOD ESTATES STAGE 2BD, HATFIELDS BEACH

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Lot No.	Comments	Topsoil Depth (mm)	Ultimate Bearing (kPa)	AS2870 :2011 Class
10	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
11	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
12	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
13	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
14	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
15	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	190	300	S
16	Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	270	300	S
17	Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
18	Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	270	300	S
19	Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	260	300	S
20	Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
21	Batter specific design zone restrictions (refer clause 6.3(b)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	220	300	S

GEOTECHNICAL COMPLETION REPORT FOR BEACHWOOD ESTATES STAGE 2BD, HATFIELDS BEACH

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Lot No.	Comments	Topsoil Depth (mm)	Ultimate Bearing (kPa)	AS2870 :2011 Class
22	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
23	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	250	300	S
24	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	280	300	S
25	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Service line within lot (refer clause 6.3(e)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	240	300	S
39	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	250	300	S
40	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
41	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
42	Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
61	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	250	300	S
62	Batter specific design zone and leading edge pile restrictions (refer clause 6.3(b)) Retaining wall restriction (refer clause 6.3(f)) Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	220	300	S